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Computer programs for helicopter data display and conceptual design

Bishop, Gary M.

Monterey, California. Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

COMPUTER PROGRAMS FOR HELICOPTER DATA DISPLAY
AND CONCEPTUAL DESIGN

by

Gary M. Bishop

December 1983

Thesis Advisor: Donald M. Layton

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Computer Programs for Helicopter Data Display and Conceptual Design

by

Gary M. Bishop
Captain, United States Army
B.S., United States Military Academy, 1975

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ABSTRACT

This thesis allows a person with access to a computer that uses the FORTRAN language and that is equipped with the DISSPLA software system the ability to select and graphically portray for analysis the critical design parameters of actual helicopters. It also allows a person with access to any computer that uses the FORTRAN language the ability to do a complete conceptual design of a helicopter at one sitting in accordance with the procedures in the Helicopter Design Manual published as course notes for the AE 4306 Helicopter Design course at the Naval Postgraduate School.

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I. INTRODUCTION

A. BACKGRCUND

The helicopter industry, as in most industries, incorporates many of the attributes of its previous designs into its new products. New aircraft are generally built upon the successes of previous designs with minor changes due to technological advances. These technological advances usually relate to new materials and new methods of control but hardly ever result in drastic changes to the aerodynamic surfaces. These proven designs of the integral parts which have specific aerodynamic characteristics are well documented and extremely useful in the design process. It is essential for the designer to have this corporate knowledge of design trends for the design process as well as for the validation of his design. This knowledge of design trends is necessary for both the designer in industry and the student in a learning environment.

Outside of specific helicopter companies, little has been done to analyze the interrelationships that exist between design parameters. These interrelationships provide a bases for the simplification of assumptions and validation of design results. This knowledge needs to be available to

the design student just as it is to the design engineer so that the information can be used for an analysis or verfication during the design process. Therefore, it is important that this information be readily available and that the student have quick, easy and well defined access to this information.

The retrieval and analysis of historical data is but one part of the design process. The critical part is the actual process whereby a conceptual design is accomplished through many iterations. This process is long and involved but provides the design student with a basic understanding of the design process. For a more indepth study of the design process it is necessary for the student to vary as many of the design parameters as possible in order to see the interrelationships that exist. This process also allows the student to become intimately familiar with the problems and needs of the designer.

To date, no known programs for the IBM 3033 have been prepared that will take the design student through the entire process from historical analyses to conceptual design completion.

B. GOALS

The objective of this study was to develop an interactive capability for the design student using the IBM 3033 computer. The program, if used at the Naval Postgraduate School, should be capable of providing graphical representations of the critical data necessary for a proper analysis in the data analysis phase. During the conceptual design phase the program should allow for design student/computer interaction so that the design student can readily see the effects of varying critical parameters. To maximize the assets available at the Naval Postgraduate School, the Tektronix 618 dual screen system and the DISSPLA [Ref. 1] software system should be incorporated in the structuring of the computer programs.

The programs should be designed primarily for the use of Aeronautical Engineering students at the Naval Postgraduate School enrolled in the Helicopter Performance, Helicopter Design, and Advanced Helicopter Design courses.

II. APPROACH TO THE PROBLEM

A. INTRODUCTION

The basic approach was to write two computer programs utilizing the DISSPLA software system for use on the IBM 3033 using FORTRAN IV. The programs are completely interactive, prompting the user for all necessary information and then graphically depicting the information in the form of tables on the IBM 3278 screen or as a graph on either the Tektronix 618 screen or by use of the VERSATEC plotter. If the Tektronix machine is used, the displayed graph can be copied directly using electrostatic copiers attached to each machine.

B. ANALYSIS OF HELICOPTER DESIGN DATA

The first program consists of a historical data display system that takes thirty critical design parameters and allows the user to select the parameters for analysis. The user can then specify the page format as well as the number of graphs per page of the finished graph. Subroutines within the program are as follows:

1. Block data
2. Data point identification
3. Graphical display formatting

C. CONCEPTUAL HELICOPTER DESIGN

The second program is written to correspond procedurally WITH THE Helicopter Design Manual [Ref. 2] used in the AE 4306 Helicopter Design course at the Naval Postgraduate School. The formulae necessary for the computation of each section is provided in lieu of subroutine use. This allows for quick and easy updating of the program as it becomes necessary. Also, if the student desires, it can be seen how the data that is received is computed. This program is completely interactive and requires only that the student have the information listed on the design specification sheet and the accompanying charts and references necessary for the required decisions during the design process. All tables and graphs are generated and displayed either on the IBM 3278 screen or the Tektronix 618 screen. Output for the tabular data is provided on a separate file and the single graph needed for design decisions can be obtained using the electrostatic printers.

Detailed knowledge of the IBM 3033 computer is not necessary. A familiarity of helicopter aerodynamics and performance is, however, necessary for proper utilization of the program in order to obtain meaningful design information.

III. SOLUTIONS TO THE PROBLEMS

A. DATA DISPLAY PROGRAM

Table I lists the thirty critical design parameters used most often in any analysis of an aircrafts performance as found in the Helicopter Performance Manual [Ref. 3].

TABLE I

Design Parameters

Main rotor radius
Tail rotor radius
Number of main rotor blades
Number of tail rotor blades
Height of the main rotor system
Speed of the main rotor
Speed of the tail rotor
Chord of the main rotor
Chord of the tail rotor
Span of the main rotor
Span of the tail rotor
Twist of the main rotor blade
Twist of the tail rotor blade
Profile drag of the main rotor blade
Profile drag of the tail rotor blade
Disc loading of the main rotor system
Width of the fuselage
Length of the fuselage
Frontal equivalent flat plate area
Vertical equivalent flat plate area
Maximum forward velocity
Maximum range
Rate of climb
Hover ceiling (IGE)
Hover ceiling (OGE)
Length of the tail
Operating weight
Load weight
Fuel weight
Maximum gross weight

The above parameters have been deemed those most critical to the design process. The airfoil data has been extrapolated from NACA data and the specific helicopter

performance parameters have been extrapolated from the various manuals for the specific helicopters. Tables III through X, Appendix C, list the specific data utilized for the study.

Table II lists the helicopters used for the analysis portion of the graphing.

TABLE II

Representative Helicopters

Military Designator	Weight Classification	Branch of Service
AH-64	Medium	USA
OH-6A	Light	USA
SH-3H	Medium	USN
S-76	Medium	USN
UH-60A	Medium	USA/USN
CH-54B	Heavy	USA
CH-53D	Heavy	USN
CH-53E	Heavy	USN

All the helicopters selected for study were single main rotor helicopters that are still in the active inventories of the agencies listed. The selections were made with deference to aircraft of the U.S. Army and U.S. Navy and then to a representative sampling of the three major weight classifications.

The data from Tables III through X can now be graphed in the following combinations using the Data Display program:

1. Simple X-Y plot

a. Horizontal page format (11 X 8.5 inches)

b. Vertical page format (8.5 X 11 inches)

2. Two parameters versus a third

a. Horizontal page format (11 X 8.5 inches)

(1) Two axes on the abscissa scale

(2) Two axes on the ordinate scale

b. Vertical page format (8.5 X 11 inches)

(1) Two axes on the abscissa scale

(2) Two axes on the ordinate scale

3. Two X-Y plots on the same page with a horizontal page format

4. Three parameters versus one common parameter with a vertical page format

5. Four separate X-Y plots on the same page with a horizontal page format

Figures 3.1. through 3.9., Appendix C, illustrate the capability of the program. The program was devised so as to allow the greatest flexibility for the analyst as to the graphical presentation.

B. CONCEPTUAL DESIGN PROGRAM

The design process is in accordance with the procedural steps as outlined in the Helicopter Design Manual. The

program is devised so as to allow the design student the ability to do a complete conceptual design at one sitting if he is properly prepared. The program lists all critical tables and information necessary for doing an analysis of the design and also provides the necessary information to prepare a written report. If the Tektronix dual screen combination is used, the student has a graphical representation of the total power curve at altitude presented to him which must be used to extrapolate critical design performance parameters. Figure 3.10. is a sample of the graphical representation provided. Sample output is provided in Appendix B to illustrate the capabilities of the program and the possible usefulness to the design student.

IV. RESULTS AND CONCLUSIONS

A. DATA DISPLAY PROGRAM

This program provided good results in use for the analyses of the design parameters considered, particularly in the correlation between commonly used 'rules of thumb' and graphical analyses of the same parameters.

The capability of the program could be enhanced in several ways. First, additional single main rotor helicopters could be added to enable a more complete analysis to be accomplished. Second, the use of different scales, such as the logrithmic scale, for the graphical analysis could prove to be more suitable for some of the parameters. Third, additional parameters that other companies have compiled in their technical manuals could be added for analysis.

B. CONCEPTUAL DESIGN PROGRAM

This program provided information consistent with existing aircraft. The interactive characteristic of the program allows the student to actively participate in the design process and, most importantly, the program allows the student to vary parameters and see the effects of changing a

single parameter on the entire design process. If the student was prepared and had all the appropriate references, this process need only take an hour to complete one iteration of the entire process. This allows for multiple iterations, optimization, and parameter variation.

One problem with the program is that it is only as good as the assumptions that have been made for the model to simplify the formulae used as given in Reference 3. A crude approximation to existing aircraft can be made with the understanding that the aircraft designed during this process is merely a conceptual design and the beginning step in the process for the final product. This model has been developed so that changes made to the course can be incorporated easily and that any corrections can be made quickly. This program also can be run on any FORTRAN capable computer using the coding listed in Appendix B.

APPENDIX A

A. USERS GUIDE TO THE DATA DISPLAY PROGRAM

The program has been written with the user in mind. It is completely interactive once the program has been loaded into the DISSPLA mode so that the user need only read the instructions presented on the screen carefully.

Use the following procedure to invoke the Data Display program once the Fortran program resides on the users disk.

1. Logon as normal at either a regular IBM 3278 terminal or at a Tektronix 618 dual screen terminal

2. Obtain the use of temporary storage space by entering the following:

   DEFINE STORAGE 1M (enter)

3. When the PSW '00020000 00000000' appears on the screen type in:

   I CMS (enter)

4. If the program has not been previously compiled on your disk type in:

   FORTGI HELODATA (enter)

5. When the program has been compiled you are ready to enter into DISSPLA by typing in:

   DISSPLA HELODATA (enter)

6. Follow the instructions given on the screen. If you desire a hard copy of the graphs do the following:

   IBM terminal--Exit the program and enter DISSPOP and then follow the instructions

TEK terminal--Press the hard copy button
on the large monitor

B. PROGRAM NOMENCLATURE

MNEMONIC	DEFINITION
ANS	General variable for reading keyboard answers
B	Number of main rotor blades
BTR	Number of tail rotor blades
C	Chord of a main rotor blade in feet
CDO	Profile drag of a main rotor blade section
CDOTR	Profile drag of a tail rotor blade section
CTR	Chord of a tail rotor blade in feet
DL	Disc loading of the main rotor system
FH	Frontal effective flat plate area in square feet
FV	Vertical effective flat plate area in square feet
FWT	Fuel weight in pounds
HOVIGE	Hover ceiling (in ground effect) in feet
HOVOGE	Hover ceiling (out of ground effect) in feet
HT	Height of the main rotor system above the ground in feet
I	Do loop variable
IPAK	Array for packing legend information
KINDS	Array for packing legend information
LGH	Length of the fuselage in feet
LT	Length of the tail in feet

LWT	Load weight in pounds
MGW	Maximum gross weight in pounds
OPTION	Term used in Switch subroutine for page formatting
OWT	Operating weight in pounds
PANS	References page format selection
R	Main rotor radius in feet
RC	Maximum rate of climb in feet per minute
RNG	Maximum range in nautical miles
RPM	Speed of the main rotor system in RPM
RPMTR	Speed of the tail rotor system in RPM
RS	Span of a main rotor blade in feet
RSTR	Span of a tail rotor blade in feet
RTR	Tail rotor radius in feet
TEMP1	Dummy parameter returned from subroutine
TEMP2	Dummy parameter returned from subroutine
TEMP3	Dummy parameter returned from subroutine
TITALT	Program trip used in multiple axes plotting
TWOAX	References which axis has two axes plotted
TWST	Twist of a main rotor blade in degrees
TWSTR	Twist of a tail rotor blade in degrees
VM	Maximum velocity in knots
WDT	Width of the fuselage in feet
X	Array returned from Switch subroutine containing abscissas for plotting

XANS	Answer referenced to X axis selection
XANS1	Answer referenced to multiple X axes selection
XANS2	Answer referenced to multiple X axes selection
XMAX	Maximum value of abscissa desired for plotting
XORIG	Minimum value of abscissa desired for plotting
XPOS	Array of values referencing subplot locations of abscissas
XSTP	Increment size between minimum and maxium of the abscissa axis
XTWO	Array returned from Switch subroutine containing abscissas for plotting
X2ANS	Array for X axis answers for two graph option
X4ANS	Array for X axis answers for four graph option
Y	Array returned from Switch subroutine containing ordinates for plotting
YANS	Answer referenced to Y axis selection
YANS1	Answer referenced to multiple Y axes selection
YANS2	Answer referenced to multiple Y axes selection
YMAX	Maximum value of abscissa desired for plotting
YORIG	Minimum value of ordinate desired for plotting
YPOS	Array of values referencing subplot locations of ordinates
YSTP	Increment size between minimum and maxium of the abscissa axis
YTWO	Array returned from Switch subroutine containing ordinates for plotting
Y2ANS	Array for Y axis answers for two graph option
Y3ANS	Array for Y axis answers for three graph option

Y4ANS	Array for Y axis answers for four graph option
Z	Array in subroutine switch for parameters

C. PROGRAM LISTING

```
      REAL R(8),RTR(8),B(8),BTR(8),HT(8),RPM(8),RPMTR(8),C(8),CTR(8)
      REAL RS(8),RSTR(8),TWST(8),TWSTTR(8),CDO(8),CDOTR(8),DL(8)
      REAL WCT(8),LGH(8),FH(8),FV(8),VM(8),RNG(8),RC(8),HOVIGE(8)
      REAL HOVOGE(8),LT(8),OWT(8),LWT(8),FWT(8),MGW(8)
      REAL YORIG,YSTP,YMAX,XORIG,XSTP,XMAX,XANS,YANS,XANS1,XANS2,X3ANS,Y
     1ANS2,YANS2,TITALT,TWOAX,ANS,PANS,XTWO
     2(8),YTWC(8),TEMP1,TEMP2,TEMP3,XPOS(9),YPOS(9),Y3ANS(3),X4ANS(4),Y4
     3ANS(4),X2ANS(2),Y2ANS(2),X(8),Y(8)
      INTEGER I,KINDS(200),IPAK(200)
      DATA XPOS/1.5,6.5,1.,1.,1.,1.,6.5,1.,6.5/
      DATA YPOS/1.,1.,1.,3.75,6.5,1.,1.,4.,4./
      COMMON /C1/ R,RTR,B,BTR,HT,RPM,RPMTR,C,CTR,RS,RSTR,TWST,TWSTTR,CDO
     1,CDOTR,CL,WCT,LGH,FH,FV,VM,RNG,RC,HOVIGE,HOVOGE,LT,OWT,LWT,FWT,MGW
C***********************************************************************
C THIS SECTION DETERMINES WHICH TYPE OF TEKTRONIX EQUIPMENT THAT YOU   *
C ARE USING AND MAKES THE APPROPRIATE CALLS TO BRING THE SYSTEM ON     *
C LINE                                                                 *
C***********************************************************************
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,37C)
      WRITE (6,38C)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 360
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,39C)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 10
      CALL TEK618
      GO TO 30
10    IF (ANS.NE.2.) GO TO 20
      CALL TEKALL (4662,30,31,1,0)
      GO TO 30
20    IF (ANS.NE.3.) GO TO 340
      CALL CCMPRS
30    CONTINUE
      CALL SWISSL
      CALL SETCLR ('BLACK')
      CALL HEIGHT (.1)
C***********************************************************************
C THIS PORTION    PACKS THE INFORMATION INTO AN ARRAY SO THAT A STORY  *
C CAN BE PRINTED ONTO EACH GRAPH WITH THE MEANING OF THE NUMBERS THAT  *
C LABELS GIVE FOR EACH PLOT                                            *
C***********************************************************************
      CALL LINES ('1. AH-64     5. UH-60A$',KINDS,1)
```

```
      CALL LINES ('2. OH-6A   6. CH-54B$',KINCS,2)
      CALL LINES ('3. SH-3H    7. CH-53D$',KINDS,3)
      CALL LINES ('4. S-76      8. CH-54E$',KINDS,4)
      CALL RESET ('HEIGHT')
      CALL MARKER (15)
      CALL SHDCHR (90.,1,0.002,1)
      CALL HWSCAL ('SCREEN')
C***********************************************************************
C THIS SECTION ALLOWS THE USER TO SELECT IF THEY WANT 1 GRAPH, 2        *
C GRAPHS HORIZONTALLY SIDE BY SIDE, 3 GRAPHS VERTICALLY WITH THE SAME   *
C X AXIS OR FOUR GRAPHS ON THE SAME PAGE.                               *
C***********************************************************************
      WRITE (6,400)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.0) GO TO 280
C***********************************************************************
C THIS SECTION PRESENTS THE 30 DIFFERENT PARMATERS THAT CAN BE USED IN *
C COMPARISONS AND ALLOWS THE USER TO SELECT UP TO 3 FOR COMPARISON      *
C***********************************************************************
      TITALT=0.0
      WRITE (6,410)
      WRITE (6,420)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C IF ONLY 2 PARAMTERS ARE SELECTED , A CHOICE OF PAGE FORMAT IS GIVEN  *
C AND A CHOICE OF WHICH PARAMTER IS TO BE ON WHICH AXIS IS GIVEN.       *
C SUBROUTINES ARE CALLED WHICH CHANGE THE PARMATER SELECTED VALUES INTO*
C VALUES TO BE PLOTTED ALONG WITH THEIR RESPECTIVE PLOTTING INFORMATION*
C***********************************************************************
      IF (ANS.NE.2.) GO TO 60
      WRITE (6,430)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 40
      WRITE (6,540)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL AREA2D (9.,6.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,6.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,6.25)
      CALL HEIGHT (.1)
      CALL LSTORY (KINDS,4,7.25,6.25)
```

```
      CALL RESET ('HEIGHT')
      GO TO 50
40    IF (ANS.NE.2.) GO TO 340
      WRITE (6,550)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (8.5,11.)
      CALL HWROT ('AUTO')
      CALL AREA2D (6.,8.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,8.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,8.25)
      CALL LSTORY (KINDS,4,4.25,8.25)
50    CONTINUE
      WRITE (6,410)
      WRITE (6,440)
      READ (5,*) XANS,YANS
      CALL FRTCMS ('CLRSCRN 6')
      CALL FRAME
      CALL XAXEND ('NCENDS')
      CALL YAXEND ('NCENDS')
      CALL SWITCH (XANS,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS,2.,Y,YORIG,YSTP,YMAX)
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      TITALT=0.0
      GO TO 180
C**********************************************************************
C SINCE 3 PARAMETERS WERE CHOSEN, THE USER IS GIVEN A CHOICE OF PAGE   *
C FORMAT (HORIZONTAL OR VERTICAL) AND WHICH AXIS HE WANTS TO HAVE TWO  *
C SCALES LOCATED ON.  SUBROUTINES ARE USED WHICH PROVIDE A SELECTION   *
C OF DESIRED PARAMTERS AND CALL THEIR APPROPRIATE FORMATS AND RETURN   *
C VALUES TO BE PLOTTED.  A SECOND SET OF DATA FOR ONE AXIS MUST BE     *
C DEFERRED DUE TO DISSPLA LEVEL REQUIREMENTS, THEREFORE, A VARIABLE    *
C HAS BEEN DESIGNATED TO TRIP A LATER SUBROUTINE WHERE THE ADDITIONAL  *
C CALL TO A SUBROUTINE FOR ADDITIONAL AXES CAN BE MADE                 *
C**********************************************************************
60    CONTINUE
      CALL HEIGHT (.1)
      CALL MYLEGN (' ',1)
      CALL SETCLR ('RED')
      CALL LINES ('PRIMARY AXES$',IPAK,1)
      CALL SETCLR ('GREEN')
```

```
      CALL LINES ('SECONDARY AXES$',IPAK,2)
      CALL SETCLR ('BLACK')
      CALL RESET ('HEIGHT')
      IF (ANS.NE.3.) GO TO 340
      WRITE (6,430)
      READ (5,*) PANS
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,450)
      READ (5,*) TWOAX
      CALL FRTCMS ('CLRSCRN 6')
      IF (PANS.NE.1.) GO TO 70
      IF (TWOAX.NE.1.) GO TO 110
      GO TO 90
70    IF (PANS.NE.2.) GO TO 340
      IF (TWOAX.NE.1.) GO TO 80
      GO TO 130
80    IF (TWOAX.NE.2.) GO TO 340
      GO TO 150
90    CONTINUE
      WRITE (6,560)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
      WRITE (6,460)
      READ (5,*) XANS1,XANS2,YANS
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL PHYSOR (1.5,2.)
      CALL AREA2D (9.,5.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,5.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,5.25)
      CALL LSTCRY (KINDS,4,7.25,5.25)
      CALL SWITCH (XANS1,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS,2.,Y,YORIG,YSTP,YMAX)
      DO 100 I=1,8
      YTWO(I)=Y(I)
100   CONTINUE
      TITALT=1.0
      GO TO 170
110   CONTINUE
      WRITE (6,570)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
```

```
      WRITE (6,470)
      READ (5,*) XANS,YANS1,YANS2
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL PHYSOR (2.5,1.0)
      CALL AREA2D (7.5,6.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,6.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,6.25)
      CALL LSTORY (KINDS,4,5.75,6.25)
      CALL SWITCH (XANS,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS1,2.,Y,YORIG,YSTP,YMAX)
      DO 120 I=1,8
      XTWO(I)=X(I)
120   CONTINUE
      TITALT=2.0
      GO TO 170
130   CONTINUE
      WRITE (6,580)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
      WRITE (6,460)
      READ (5,*) XANS1,XANS2,YANS
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (8.5,11.)
      CALL HWROT ('AUTO')
      CALL PHYSOR (1.5,2.)
      CALL AREA2D (6.5,7.5)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,8.)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,7.75)
      CALL LSTORY (KINDS,4,4.75,7.75)
      CALL SWITCH (XANS1,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS,2.,Y,YORIG,YSTP,YMAX)
      DO 140 I=1,8
      YTWO(I)=Y(I)
140   CONTINUE
      TITALT=3.0
      GO TO 170
150   CONTINUE
      WRITE (6,590)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
```

```
      WRITE (6,410)
      WRITE (6,470)
      READ (5,*) XANS,YANS1,YANS2
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (8.5,11.)
      CALL HWROT ('AUTO')
      CALL PHYSOR (2.25,1.)
      CALL AREA2D (5.75,8.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,8.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,8.25)
      CALL LSTORY (KINDS,4,4.,8.25)
      CALL SWITCH (XANS,1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (YANS1,2.,Y,YORIG,YSTP,YMAX)
      DO 160 I=1,8
      XTWO(I)=X(I)
160   CONTINUE
      TITALT=4.0
      GO TO 170
170   CONTINUE
C*********************************************************************
C NORMAL DISSPLA CALLS TO ESTABLISH THE STYLE OF WRITING, PUTTING A   *
C BORDER AROUND THE SUBPLOT AREA, MAKING A GENERIC HEADING, SUPPRESSING*
C PRINTED VALUES AT THE ENDS OF THE AXES OF THE GRAPH, CALLING THE    *
C AXES, THEIR INCREMENT AND THEIR VALUES TO BE DRAWN, CALLING THE CURVE*
C THAT PLOTS ONLY A MARKER AND THEN CALLING A ROUTINE THAT LABELS THE *
C MARKERS BY THE TYPE OF AIRCRAFT                                     *
C*********************************************************************
      CALL SETCLR ('RED')
      CALL FRAME
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      CALL RESET ('HEIGHT')
C*********************************************************************
C SECONDARY AXIS IS DRAWN WITH APPROPRIATE TITLE AND VALUES AND THEN A *
C PLOT OF THE NEW POINTS IS MADE AND THEIR POINTS LABELLED            *
C*********************************************************************
180   CONTINUE
      IF (TITALT.NE.0.0) GO TO 190
      GO TO 350
190   IF (TITALT.NE.1.0) GO TO 200
      CALL SWITCH (XANS2,3.,XTWO,TEMP1,TEMP2,TEMP3)
```

```
      GO TO 230
200   IF (TITALT.NE.2.0) GO TO 210
      CALL SWITCH (YANS2,4.,YTWO,TEMP1,TEMP2,TEMP3)
      GO TO 230
210   IF (TITALT.NE.3.0) GO TO 220
      CALL SWITCH (XANS2,5.,XTWO,TEMP1,TEMP2,TEMP3)
      GO TO 230
220   CONTINUE
      CALL SWITCH (YANS2,6.,YTWO,TEMP1,TEMP2,TEMP3)
      GO TO 230
230   CONTINUE
      CALL SETCLR ('GREEN')
      CALL MARKER (16)
      CALL CURVE (XTWO,YTWO,8,-1)
      CALL LABEL (XTWO,YTWO)
      CALL RESET ('HEIGHT')
      IF (TITALT.NE.1.) GO TO 240
      CALL LEGEND (IPAK,2,0.2,4.5)
      GO TO 270
240   IF (TITALT.NE.2.) GO TO 250
      CALL LEGEND (IPAK,2,0.2,5.5)
      GO TO 270
250   IF (TITALT.NE.3.) GO TO 260
      CALL LEGEND (IPAK,2,0.2,7.)
      GO TO 270
260   IF (TITALT.NE.4.) GO TC 340
      CALL LEGEND (IPAK,2,0.2,7.5)
      GO TO 270
270   CONTINUE
      CALL RESET ('MARKER')
      GO TO 350
C*********************************************************************
C THIS SECTION ALLOWS THE USER TO SELECT 2 SEPARATE GRAPHS ON THE    *
C SAME PAGE CN A HORIZONTAL PAGE FORMAT.                             *
C*********************************************************************
280   IF (ANS.NE.2.) GO TO 340
      WRITE (6,480)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.2.0) GO TO 300
      WRITE (6,600)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
C
      WRITE (6,410)
      WRITE (6,490)
      READ (5,*) X2ANS(1),Y2ANS(1),X2ANS(2),Y2ANS(2)
```

```
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL AREA2D (9.,6.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.25,6.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.45,6.25)
      CALL LSTORY (KINDS,4,7.5,6.25)
      CALL ENDGR (0)
      DO 290 I=1,2
      CALL SETCLR ('RED')
      CALL PHYSOR (XPOS(I),YPOS(I))
      CALL AREA2D (3.85,6.)
      CALL FRAME
      CALL HEIGHT (.14)
      CALL SWITCH (X2ANS(I),1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (Y2ANS(I),2.,Y,YORIG,YSTP,YMAX)
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      CALL ENDGR (0)
290   CONTINUE
      CALL SETCLR ('BLACK')
      GO TO 350
C************************************************************************
C THIS SECTION ALLOWS THE USER TO PUT 3 GRAPHS WITH A COMMON X AXIS     *
C ON ONE VERTICAL PAGE PLACED ONE ON TOP OF THE OTHER.                  *
C************************************************************************
300   IF (ANS.NE.3.0) GO TO 320
      WRITE (6,610)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
      WRITE (6,500)
      READ (5,*) XANS,Y3ANS(1),Y3ANS(2),Y3ANS(3)
      CALL FRTCMS ('CLRSCRN 6')
      CALL HWROT ('AUTO')
      CALL PAGE (8.5,11.)
      CALL AREA2D (7.,7.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,0.,8.)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,1.2,7.75)
```

```
      CALL LSTCRY (KINDS,4,5.25,7.75)
      CALL ENDGR (0)
      CALL SETCLR ('GREEN')
      CALL PHYSOR (XPOS(3),YPOS(3))
      CALL AREA2D (7.,2.5)
      CALL FRAME
      CALL SWITCH (XANS,1.,X,XORIG,XSTP,XMAX)
      CALL HEIGHT (.10)
      CALL SWITCH (Y3ANS(1),2.,Y,YORIG,YSTP,YMAX)
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL CURVE (X,Y,8,-1)
      CALL RESET ('HEIGHT')
      CALL LABEL (X,Y)
      CALL ENDGR (0)
      DO 310 I=1,2
      CALL PHYSOR (XPOS(I+3),YPOS(I+3))
      CALL AREA2D (7.,2.5)
      CALL FRAME
      CALL SWITCH (XANS,7.,X,XORIG,XSTP,XMAX)
      CALL HEIGHT (.10)
      CALL SWITCH (Y3ANS(I+1),2.,Y,YORIG,YSTP,YMAX)
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL XNONUM
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      CALL RESET ('HEIGHT')
      CALL ENDGR (0)
310   CONTINUE
      CALL SETCLR ('BLACK')
      GO TO 350
C*****************************************************************************
C THIS SECTION ALLOWS THE USER TO PUT 4 GRAPHS ON A HORIZONTAL PAGE,        *
C BASICALLY DIVIDE THE PAGE IN QUARTERS, WITH WHATEVER AXES WANTED.          *
C*****************************************************************************
320   CONTINUE
      IF (ANS.NE.4.0) GO TO 340
      WRITE (6,620)
      READ (5,*) ANS
      IF (ANS.NE.1.) GO TO 340
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,410)
      WRITE (6,510)
```

```
      READ (5,*) X4ANS(1),Y4ANS(1),X4ANS(2),Y4ANS(2),X4ANS(3),Y4ANS(3),X
     14ANS(4),Y4ANS(4)
      CALL FRTCMS ('CLRSCRN 6')
      CALL PAGE (11.,8.5)
      CALL AREA2D (9.,5.)
      CALL HEIGHT (.3)
      CALL MESSAG ('HELICOPTER DESIGN$',-100,-.25,5.5)
      CALL RESET ('HEIGHT')
      CALL MESSAG ('AE 4306/4900$',100,.95,5.25)
      CALL LSTORY (KINDS,4,7.5,5.25)
      CALL ENDGR (0)
      DO 330 I=1,4
      CALL PHYSOR (XPOS(I+5),YPOS(I+5))
      CALL SETCLR ('RED')
      CALL AREA2D (4.,2.5)
      CALL FRAME
      CALL HEIGHT (.10)
      CALL SWITCH (X4ANS(I),1.,X,XORIG,XSTP,XMAX)
      CALL SWITCH (Y4ANS(I),2.,Y,YORIG,YSTP,YMAX)
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL GRAF (XORIG,XSTP,XMAX,YORIG,YSTP,YMAX)
      CALL RESET ('XTICKS')
      CALL RESET ('YTICKS')
      CALL CURVE (X,Y,8,-1)
      CALL LABEL (X,Y)
      CALL RESET ('HEIGHT')
      CALL ENDGR (0)
330   CONTINUE
      CALL SETCLR ('BLACK')
      GO TO 350
C*********************************************************************
C THIS SECTION ALLOWS THE USER TO REMAIN WITHIN THE PROGRAM IF HE     *
C MAKES A MISTAKE IN ENTERING DATA.                                   *
C*********************************************************************
340   CONTINUE
      WRITE (6,520)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 360
      GO TO 30
350   CONTINUE
      CALL ENDPL (0)
C*********************************************************************
C  THIS SECTION IS USED TO ALLOW THE USER TO MAKE ADDITIONAL GRAPHS   *
C  WITHOUT LEAVING THE PROGRAM AND HAVING TO REINITIATE DISSPLA       *
C*********************************************************************
      WRITE (6,530)
```

```
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 360
      CALL RESET ('ALL')
      GO TO 30
360   CONTINUE
      CALL DONEPL
      STOP
C*************************************************************************
370   FORMAT (53H1THIS IS AN INTERACTIVE PROGRAM FOR YOU TO BE ABLE TO,2
     10H GRAPHICALLY DISPLAY,/,36H THE VARIOUS DESIGN PARAMETERS THAT ,3
     29H YOU HAVE BEEN EXPOSED TO IN HELICOPTER,/,15H DESIGN. PLEASE,53H
     3 ENTER A NUMBER AS A RESPONSE TO THE QUESTIONS ASKED.,////,9X,53H*
     4*********  PLEASE FOLLOW THE INSTRUCTIONS **********)
380   FORMAT (//////,18X,38H ENTER A "1" IF YOU DESIRE TO CONTINUE,/,18X
     1,39H_______________________________________)
390   FORMAT (//////,11X,45HPLEASE ENTER THE TYPE OF MACHINE THAT YOU AR
     1E,10H USING NOW,/,10X,57H__________________________________________
     2_______________,///,20X,27H1. TEK 618/3278 COMBINATION,//,20X,11H
     32. TEK 4114,//,20X,25H3. VERSATEC USING DISSPOP)
400   FORMAT (//////6X,47HDO YOU WANT ONE GRAPH OR MULTIPLE GRAPHS ON TH
     1E,11H SAME PAGE:,/,5X,60H___________________________________________
     2_________________,///,10X,32H1.  ONE GRAPH ONLY WITH MULTIPLE,16
     3H AXES IF DESIRED,//,10X,19H2.  MULTIPLE GRAPHS)
410   FORMAT (5X,22H1.   MAIN ROTOR RADIUS,13X,9H16.  DISC,8H LOADING,/,
     15X,22H2.   TAIL ROTOR RADIUS,13X,13H17.  FUSELAGE,6H WIDTH,/5X,32H
     23.   NUMBER OF MAIN ROTOR BLADES,3X,11H18.  LENGTH,12H OF FUSELAGE
     3,/,5X,32H4.   NUMBER OF TAIL ROTOR BLADES,3X,5H19.  ,26HHORIZONTAL
     4 FLAT PLATE AREA,/,5X,24H5.   ROTOR SYSTEM HEIGHT,11X,29H20.  VERT
     5ICAL FLAT PLATE AREA,/,5X,19H6.   MAIN ROTOR RPM,16X,21H21.  MAXIM
     6UM VELOCITY,/,5X,19H7.   TAIL ROTOR RPM,16X,5H22.  ,17HMAXIMUM RAN
     7GE(NM),/,5X,27H8.   MAIN ROTOR BLADE CHORD,8X,5H23.  ,13HRATE OF C
     8LIMB,/,5X,27H9.   TAIL ROTOR BLADE CHORD,8X,5H24.  ,17HIGE HOVER C
     9EILING,/,5X,26H10.  MAIN ROTOR BLADE SPAN,9X,5H25.  ,17HOGE HOVER
     $CEILING,/,5X,26H11.  TAIL ROTOR BLADE SPAN,9X,5H26.  ,14HLENGTH OF
     $ TAIL,/,5X,27H12.  MAIN ROTOR BLADE TWIST,8X,5H27.  ,16HOPERATING
     $WEIGHT,/,5X,27H13.  TAIL ROTOR BLADE TWIST,8X,5H28.  ,11HLOAD WEIG
     $HT,/,5X,25H14.  MAIN ROTOR BLADE CDO,10X,5H29.  ,11HFUEL WEIGHT,/,
     $5X,25H15.  TAIL ROTOR BLADE CDO,10X,5H30.  ,16HMAX GROSS WEIGHT/)
420   FORMAT (//4X,44H HOW MANY PARAMETERS DO YOU WANT TO COMPARE?,/,20H
     1       (MAXIMUM OF 3))
430   FORMAT (///8X,45H WHAT TYPE OF GRAPHICAL FORMAT DO YOU DESIRE:,/,8
     1X,46H______________________________________________,//,47X,3H2. ,1
     24H______________,/,50X,1HI,12X,1HI,/,50X,1HI,12X,1HI,/,12X,3H1. ,2
     30H____________________,15X,1HI,2X,8HVERTICAL,2X,1HI,/,15X,1HI,18X,
     41HI,15X,1HI,1X,10H(8.5 X 11),1X,1HI,/,15X,1HI,4X,10HHORIZONTAL,4X,
     51HI,15X,1HI,12X,1HI,/,15X,1HI,4X,10H(11 X 8.5),4X,1HI,15X,1HI,12X,
     61HI,/,15X,20HI__________________I,15X,14HI____________I)
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440   FORMAT (53H ENTER THE X AXIS PARAMETER AND Y AXIS PARAMTER FROM ,1
     14HTHE ABOVE LIST,/,29H (ENTER THEM RESPECTIVELY AND,22H SEPARATED
     2BY A SPACE))
450   FORMAT (///15X,33H WHICH AXIS WILL HAVE TWO SCALES?,/,15X,33H__
     1________________________,//,30X,4H1. X,//,30X,4H2. Y,/,50X,14H
     2_______________,7,50X,1HI,12X,1HI,/,50X,1HI,12X,1HI,/,15X,20H____
     3_______________,13X,3HY I,2X,8HVERTICAL,2X,1HI,/,15X,1HI,18X,1HI,15
     4X,1HI,1X,10F  FORMAT  ,1X,1HI,/,13X,3HY I,4X,10HHORIZONTAL,4X,1HI,
     515X,1HI,12X,1HI,/,15X,1HI,4X,10H  FORMAT  ,4X,1HI,15X,1HI,12X,1HI,
     6/,15X,20HI__________________I,15X,14HI____________I,/,15X,20H
     7    X            ,15X,14H      X      )
460   FORMAT (47H ENTER THE TWO X AXIS PARAMETERS FIRST AND THEN,21H THE
     1 Y AXIS PARAMETER,/,22H FROM THE LIST ABOVE. ,34H (SEPARATE YOUR E
     2NTRYS BY A SPACE))
470   FORMAT (47H ENTER THE X AXIS PARAMETER FIRST AND THEN THE ,21HTWO
     1Y AXES PARAMETERS,/,22H FROM THE LIST ABOVE. ,34H (SEPARATE YOUR E
     2NTRYS BY A SPACE))
480   FORMAT (//////10X,42H DO YOU WANT 2,3, OR 4 GRAPHS ON ONE PAGE?,/,
     110X,42H__________________________________________,//,25X,12H2.   2
     2GRAPHS,77,25X,12H3.   3 GRAPHS,77,25X,12H4.   4 GRAPHS)
490   FORMAT (50H ENTER THE X AND Y AXIS FOR EACH OF THE TWO GRAPHS,/,48
     1H RESPECTIVELY STARTING WITH THE LEFT GRAPH FIRST,/,34H (SEPARATE
     2YOUR ENTRYS BY A SPACE))
500   FORMAT (49H ENTER THE X AXIS FIRST AND THEN THE THREE Y AXES,/,32H
     1 STARTING FROM THE BOTTOM GRAPH.,/,34H (SEPARATE YOUR ENTRYS BY A
     2SPACE))
510   FORMAT (56H LIST THE PARAMETERS OF YOUR X AND Y AXES FOR EACH GRAP
     1H,10H SEPARATED,/,38H BY SPACES STARTING WITH GRAPH 1 BEING,20H LO
     2WER LEFT, GRAPH 2,/,27H LOWER RIGHT, GRAPH 3 UPPER,17H LEFT AND GR
     3APH 4,/,12H UPPER RIGHT)
520   FORMAT (//////,6X,38H YOU HAVE MADE A MISTAKE-------------,/,12X,
     126H DO YOU WANT TO TRY AGAIN?,/,6X,39H___________________________
     2____________,//,22X,6H1. YES,/,22X,6H2.  NO)
530   FORMAT (7777///18X,35H DO YOU WANT TO MAKE ANOTHER GRAPH?,/,18X,36H
     1____________________________________,///,30X,7H1.  YES,//,30X,6H2.
     2  NO)
540   FORMAT (///6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--I
     1S IT CORRECT?,/,6X,59H___________________________________________
     2________________,/,30X,6HI. YES,7,30X,5H2. NO,777,19X,30H___________
     3___________________,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,7,17X,3HY
     4 I,28X,1HI,7,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/
     5,19X,30H______________________________,/,33X,1HX)
550   FORMAT (7776X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--I
     1S IT CORRECT?,/,6X,59H___________________________________________
     2________________,/,30X,6HI. YES,7,30X,5H2. NO,77,26X,15H___________
     3____,7,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,7,26X,1
     4HI,13X,1HI,/,24X,3HY I,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI
     5,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,15H_______________,/,33
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     6X,1HX)
560  FORMAT (///6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--I
     1S IT CORRECT?,/,6X,59H__________________________________________________
     2_______________,/,30X,6H1. YES,7,30X,5H2. NO,777,19X,30H____________
     3_____________________,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,7,17X,3HY
     4 I,28X,1HI,7,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/,19X,1HI,28X,1HI,/
     5,19X,30H______________________________,/,30X,9HPRIMARY X,/,29X,11H
     6SECONDARY X)
570  FORMAT (//6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--IS
     1 IT CORRECT?,/,6X,59H__________________________________________________
     2______________,/,30X,6H1. YES,7,30X,5H2. NO,77,15X,44HS____________
     3__________________________________,/,15X,7HE  P  I,36X,1HI,/,15X,7HC
     4  R  I,36X,1HI,7,15X,7HO  I  I,36X,1HI,/,15X,7HN  M  I,36X,1HI,/,1
     55X,7HD  A  I,36X,1HI,/,15X,7HA  R  I,36X,1HI,/,15X,7HR  Y  I,36X,1
     6HI,/,15X,7HY     I,36X,1HI,/,15X,7H   Y  I,36X,1HI,/,15X,44HY
     7__________________________________,/,38X,1HX)
580  FORMAT (//6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--IS
     1 IT CORRECT?,/,6X,59H__________________________________________________
     2______________,/,30X,6H1. YES,7,30X,5H2. NO,7,26X,15H______________
     3 ,7,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,7,24X,3HY
     4 I,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/
     5,26X,1HI,13X,1HI,/,26X,1HI,13X,1HI,/,26X,15H_______________,/,28X,
     69HPRIMARY X,/,27X,11HSECONDARY X)
590  FORMAT (///6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--I
     1S IT CORRECT?,/,6X,59H__________________________________________________
     2_______________,/,30X,6H1. YES,7,30X,5H2. NO,77,22X,21HS___________
     3_______________,/,22X,7HE  P  I,13X,1HI,/,22X,7HC  R  I,13X,1HI,/,22X,7
     4HO  I  I,13X,1HI,/,22X,7HN  M  I,13X,1HI,/,22X,7HD  A  I,13X,1HI,/
     5,22X,7HA  R  I,13X,1HI,/,22X,7HR  Y  I,13X,1HI,/,22X,7HY     I,13X
     6,1HI,/,22X,7H   Y  I,13X,1HI,/,22X,21HY      _______________,/,35X,
     71HX)
600  FORMAT (//6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--IS
     1 IT CORRECT?,/,6X,59H__________________________________________________
     2______________,/,30X,6H1. YES,7,30X,5H2. NO,7,19X,34H_____________
     3_______________________,/,19X,1HI,32X,1HI,/,19X,1HI,6X,8H________,6X
     4,8H________,4X,1HI,7,19X,1HI,6X,1HI,6X,1HI,6X,1HI,6X,1HI,4X,1HI,/,
     519X,1HI,6X,1HI,6X,1HI,6X,1HI,6X,1HI,4X,1HI,/,19X,1HI,6X,1HI,6X,1HI
     6,6X,1HI,6X,1HI,4X,1HI,/,19X,1HI,3X,4HY1 I,6X,1HI,3X,4HY2 I,6X,1HI,
     74X,1HI,/,19X,1HI,6X,1HI,6X,1HI,6X,1HI,6X,1HI,4X,1HI,/,19X,1HI,6X,1
     8HI,6X,1HI,6X,1HI,6X,1HI,4X,1HI,/,19X,1HI,6X,8H________,6X,8H_____
     9__,4X,1HI,/,19X,1HI,6X,8H   X1   ,6X,8H   X2   ,4X,1HI,/,19X,34H__
     $__________________________________)
610  FORMAT (/6X,42H THIS IS THE TYPE FORMAT THAT YOU SELECTED,16H--IS
     1IT CORRECT?,/,6X,59H__________________________________________________
     2_____________,/,30X,6H1. YES,7,30X,5H2. NO,7,26X,19H______________
     3_____,7,26X,1HI,17X,1HI,/,26X,1HI,4X,11H___________,2X,1HI,7,26X,6
     4HI  Y3  I,9X,1HI,2X,1HI,/,26X,1HI,4X,11H___________,2X,1HI,/,26X,1HI
     5,4X,11H___________,2X,1HI,/,26X,6HI  Y2  I,9X,1HI,2X,1HI,/,26X,1HI,4
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     6X,11H___________,2X,1HI,/,26X,1HI,4X,11H___________,2X,1HI,/,26X,6
     7HI  Y1  I,9X,1HI,2X,1HI,/,26X,1HI,4X,11H___________,2X,1HI,/,26X,1HI
     8,9X,1HX,7X,1HI,/,26X,19H___________________)
620  FORMAT (//6X,42H THIS IS THE TYPE FCRMAT THAT YOU SELECTED,16H--IS
     1 IT CORRECT?,/,6X,59H
     2______________,/,30X,6HI. YES,/,30X,5H2. NO,/,17X,35H_____________
     3______________________,/,17X,1HI,33X,1HI,/,17X,1HI,7X,8H________,5
     4X,8H________,5X,1HI,/,17X,1HI,4X,4HY3 I,6X,1HI,2X,4HY4 I,6X,1HI,5X
     5,1HI,/,17X,1HI,7X,8H________,5X,8H________,5X,1HI,/,17X,1HI,7X,8H
     6  X3    ,5X,8H   X4    ,5X,1HI,/,17X,1HI,7X,8H________,5X,8H________
     7,5X,1HI,/,17X,1HI,4X,4HY1  I,6X,1HI,2X,4HY2  I,6X,1HI,5X,1HI,/,17X,1
     8HI,7X,8H________,5X,8H________,5X,1HI,/,17X,1HI,7X,8H   X1    ,5X,8
     9H   X2    ,5X,1HI,/,17X,35H___________________________________)
      END
C*************************************************************************
C DATA USED THROUGHOUT THE PROGRAM FOR THE COMMON VARIABLES SO THAT      *
C ADDITIONAL FILEDEFS DO NOT HAVE TO BE USED.  DATA OBTAINED HEREIN      *
C IS ONLY THAT OF THE 30 PARAMTERS USED IN COMPARISON                    *
C*************************************************************************
      BLOCK DATA
      REAL R(8),RTR(8),B(8),BTR(8),HT(8),RPM(8),RPMTR(8),C(8),CTR(8)
      REAL RS(8),RSTR(8),TWST(8),TWSTTR(8),CDO(8),CDOTR(8),DL(8)
      REAL WDT(8),LGH(8),FH(8),FV(8),VM(8),RNG(8),RC(8),HOVIGE(8)
      REAL HOVOGE(8),LT(8),OWT(8),LWT(8),FWT(8),MGW(8)
      COMMON /C1/ R,RTR,B,BTR,HT,RPM,RPMTR,C,CTR,RS,RSTR,TWST,TWSTTR,CDO
     1,CDOTR,DL,WDT,LGH,FH,FV,VM,RNG,RC,HOVIGE,HOVOGE,LT,OWT,LWT,FWT,MGW
C*************************************************************************
C THE DATA IS LISTED IN THE FOLLOWING SEQUENTIAL MANNER FOR EASY         *
C MANIPULATION WITHIN THE DISSPLA PROGRAM AND FOR CONSISTENT MARKER      *
C IDENTIFICATION:                                                        *
C                 /AH64,OH6A,SH3H,S76,UH60A,CH54B,CH53D,CH54E/           *
C*************************************************************************
      DATA R/24.,16.3,31.,22.,26.8,36.,36.1,38.5/
      DATA RTR/4.6,4.3,5.3,4.,5.5,8.,8.,10./
      DATA B/4.,4.,5.,4.,4.,6.,6.,7./
      DATA BTR/4.,2.,5.,4.,4.,4.,4.,4./
      DATA HT/12.6,7.,14.3,10.,11.2,17.6,15.8,16./
      DATA RPM/289.,470.,203.,293.,258.,185.,185.,179./
      DATA RPMTR/1403.,3005.,1243.,1609.,1190.,631.,792.,699./
      DATA C/1.75,.57,1.52,1.29,1.75,1.97,2.17,2.44/
      DATA CTR/.83,.40,.61,.54,.81,1.28,1.28,1.28/
      DATA RS/18.8,11.5,29.3,25.0,23.3,29.8,28.9,28.6/
      DATA RSTR/3.1,1.4,4.,3.3,4.25,6.45,6.45,8.53/
      DATA TWST/-9.,-9.,-8.,-10.,-18.,-8.,-6.,-13.6/
      DATA TWSTTR/-8.8,-8.,0.,-8.,-18.,-8.,-8.,-8./
      DATA CDO/.009,.009,.0095,.009,.008,.0095,.0095,.009/
      DATA CDOTR/.009,.009,.0105,.015,.008,.0105,.0095,.0095/
      DATA DL/8.1,4.68,6.96,6.58,8.95,10.3,10.3,15.0/
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      DATA WCT/3.96,4.57,7.08,7.,7.75,7.08,8.83,8.83/
      DATA LGH/49.1,23.0,55.2,43.4,50.1,70.2,67.2,99.0/
      DATA FH/34.7,5.,31.3,11.6,25.7,65.,47.3,63.6/
      DATA FV/45.8,10.8,36.,30.,30.8,99.4,90.,120./
      DATA VM/154.,116.,120.,155.,156.,110.,164.,146./
      DATA RNG/246.,330.,505.,404.,275.,200.,242.,400./
      DATA RC/2490.,500.,500.,425.,200.,189.,625.,325./
      DATA HOVIGE/14200.,7100.,3700.,6200.,7800.,6300.,14000.,6000./
      DATA HOVOGE/11015.,4200.,4000.,2800.,3900.,2400.,8000.,1400./
      DATA LT/29.7,15.2,36.6,26.5,31.5,44.5,44.5,48./
      DATA OWT/11015.,1155.,13600.,5600.,10679.,19234.,23632.,33226./
      DATA LWT/2021.,995.,1759.,2517.,7226.,14186.,14030.,24791./
      DATA FWT/1624.,400.,5641.,1883.,2345.,8580.,4338.,15483./
      DATA MGW/14660.,2550.,21000.,10000.,20250.,42000.,42000.,73500./
      END
C***********************************************************************
C THIS SUBROUTINE TAKES THE X AND Y VALUES FROM THE PARAMTER SELECTION *
C SUBROUTINE(S) AND LABELS THE MARKER POINTS AS TO THE APPRJPRIATE     *
C AIRCRAFT                                                              *
C***********************************************************************
      SUBROUTINE LABEL (X,Y)
      REAL X(8),Y(8)
      CALL HEIGHT (.1)
      CALL MSHIFT (-.1,0.)
      CALL RLMESS ('1$',100,X(1),Y(1))
      CALL MSHIFT (.1,0.)
      CALL RLMESS ('2$',100,X(2),Y(2))
      CALL MSHIFT (0.,-.18)
      CALL RLMESS ('3$',100,X(3),Y(3))
      CALL MSHIFT (0.,.1)
      CALL RLMESS ('4$',100,X(4),Y(4))
      CALL MSHIFT (.1,0.)
      CALL RLMESS ('5$',100,X(5),Y(5))
      CALL MSHIFT (0.,-.18)
      CALL RLMESS ('6$',100,X(6),Y(6))
      CALL MSHIFT (0.,.1)
      CALL RLMESS ('7$',100,X(7),Y(7))
      CALL MSHIFT (.1,0.)
      CALL RLMESS ('8$',100,X(8),Y(8))
      RETURN
      END
C***********************************************************************
C SUBROUTINE USED TO SELECT THE PARAMETER DESIRED FOR THE PRIMARY X    *
C AXIS AND TO RETURN TO THE MAIN PROGRAM THE NECESSARY INFORMATION     *
C SO THAT A PLOT CAN BE MADE                                            *
C***********************************************************************
      SUBROUTINE SWITCH (Z,OPTION,X,XORIG,XSTP,XMAX)
      REAL R(8),RTR(8),B(8),BTR(8),HT(8),RPM(8),RPMTR(8),C(8),CTR(8)
```

```
      REAL RS(8),RSTR(8),TWST(8),TWSTTR(8),CDO(8),CDOTR(8),DL(8)
      REAL WDT(8),LGH(8),FH(8),FV(8),VM(8),RNG(8),RC(8),HOVIGE(8)
      REAL HOVOGE(8),LT(8),OWT(8),LWT(8),FWT(8),MGW(8),X(8)
      REAL XORIG,XSTP,XMAX,Z,OPTION
      INTEGER I
      COMMON /C1/ R,RTR,B,BTR,HT,RPM,RPMTR,C,CTR,RS,RSTR,TWST,TWSTTR,CDO
     1,CDOTR,DL,WDT,LGH,FH,FV,VM,RNG,RC,HOVIGE,HOVOGE,LT,OWT,LWT,FWT,MGW
      CALL XAXEND ('NOENDS')
      CALL YAXEND ('NOENDS')
      CALL YAXANG (0.)
      IF (Z.NE.1.) GO TO 90
      DO 10 I=1,8
      X(I)=R(I)
   10 CONTINUE
      XORIG=15.
      XSTP=5.
      XMAX=45.
      IF (OPTICN.NE.1.) GO TO 20
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR RADIUS (FT)$',100)
      GO TO 2710
   20 IF (OPTION.NE.2.) GO TO 30
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR RADIUS (FT)$',100)
      GO TO 2710
   30 IF (OPTICN.NE.3.) GO TO 40
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,'MAIN ROTOR RADIUS (FT)$'
     1            ,100,0.,-.75)
      CALL RESET ('XTICKS')
      GO TO 2710
   40 IF (OPTICN.NE.4.) GO TO 50
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,'MAIN ROTOR RADIUS (FT)$'
     1            ,100,-1.,0.)
      CALL RESET ('YTICKS')
      GO TO 2710
   50 IF (OPTION.NE.5.) GO TO 60
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,'MAIN ROTOR RADIUS (FT)$'
     1            ,100,0.,-.75)
      CALL RESET ('XTICKS')
      GO TO 2710
   60 IF (OPTICN.NE.6.) GO TO 70
      CALL YTICKS (5)
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      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,'MAIN ROTOR RADIUS (FT)$'
     1            ,100,-1.15,0.)
      CALL RESET ('YTICKS')
      GO TO 2710
70    IF (OPTICN.NE.7.) GO TO 80
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
80    CONTINUE
      GO TO 2700
90    IF (Z.NE.2.) GO TO 180
      DO 100 I=1,8
      X(I)=RTR(I)
100   CONTINUE
      XORIG=0.
      XSTP=2.
      XMAX=12.
      IF (OPTION.NE.1.) GO TO 110
      CALL XTICKS (5)
      CALL XNAME ('TAIL ROTOR RADIUS (FT)$',100)
      GO TO 2710
110   IF (OPTION.NE.2.) GO TO 120
      CALL YTICKS (2)
      CALL YNAME ('TAIL ROTOR RADIUS (FT)$',100)
      GO TO 2710
120   IF (OPTION.NE.3.) GO TO 130
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,'TAIL ROTOR RADIUS (FT)$',
     1            100,0.,-.75)
      GO TO 2710
130   IF (OPTION.NE.4.) GO TO 140
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,'TAIL RCTOR RADIUS (FT)$',
     1            100,-1.,0.)
      GO TO 2710
140   IF (OPTION.NE.5.) GO TO 150
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,'TAIL ROTOR RADIUS (FT)$',
     1            100,0.,-.75)
      GO TO 2710
150   IF (OPTICN.NE.6.) GO TO 160
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,'TAIL ROTOR RADIUS (FT)$',
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     1                100,-1.15,0.)
      GO TO 2710
160   IF (OPTION.NE.7.) GO TC 170
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
170   CONTINUE
      GO TO 2700
180   IF (Z.NE.3.) GO TO 270
      DO 190 I=1,8
      X(I)=B(I)
190   CONTINUE
      XORIG=0.
      XSTP=1.
      XMAX=9.
      IF (OPTION.NE.1.) GO TO 200
      CALL XNAME ('NUMBER MAIN ROTOR BLADES$',100)
      CALL XINTAX
      GO TO 2710
200   IF (OPTION.NE.2.) GO TO 210
      CALL YNAME ('NUMBER MAIN ROTOR BLADES$',100)
      CALL YINTAX
      GO TO 2710
210   IF (OPTION.NE.3.) GO TO 220
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'NUMBER MAIN ROTOR BLADES$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
220   IF (OPTION.NE.4.) GO TC 230
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'NUMBER MAIN ROTOR BLADES$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
230   IF (OPTION.NE.5.) GO TC 240
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'NUMBER MAIN ROTOR BLADES$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
240   IF (OPTION.NE.6.) GO TO 250
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'NUMBER MAIN ROTOR BLADES$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
250   IF (OPTION.NE.7.) GO TO 260
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      CALL XNAME (' ',1)
      GO TO 2710
260   CONTINUE
      GO TO 2700
270   IF (Z.NE.4.) GO TO 360
      DO 280 I=1,8
      X(I)=BTR(I)
280   CONTINUE
      XORIG=0.
      XSTP=1.
      XMAX=6.
      IF (OPTION.NE.1.) GO TO 290
      CALL XNAME ('NUMBER TAIL ROTOR BLADES$',100)
      CALL XINTAX
      GO TO 2710
290   IF (OPTION.NE.2.) GO TO 300
      CALL YNAME ('NUMBER TAIL ROTOR BLADES$',100)
      CALL YINTAX
      GO TO 2710
300   IF (OPTION.NE.3.) GO TO 310
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'NUMBER TAIL ROTOR BLADES$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
310   IF (OPTION.NE.4.) GO TO 320
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'NUMBER TAIL ROTOR BLADES$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
320   IF (OPTICN.NE.5.) GO TC 330
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'NUMBER TAIL ROTOR BLADES$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
330   IF (OPTION.NE.6.) GO TC 340
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'NUMBER TAIL ROTOR BLADES$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
340   IF (OPTION.NE.7.) GO TO 350
      CALL XNAME (' ',1)
      GO TO 2710
350   CONTINUE
      GO TO 2700
```

```
360   IF (Z.NE.5.) GO TO 450
      DO 370 I=1,8
      X(I)=HT(I)
370   CONTINUE
      XORIG=0.
      XSTP=5.
      XMAX=20.
      IF (OPTION.NE.1.) GO TO 380
      CALL XTICKS (5)
      CALL XNAME ('HEIGHT OF ROTOR SYSTEM (FT)$',100)
      GO TO 2710
380   IF (OPTION.NE.2.) GO TO 390
      CALL YTICKS (5)
      CALL YNAME ('HEIGHT OF ROTOR SYSTEM (FT)$',100)
      GO TO 2710
390   IF (OPTION.NE.3.) GO TO 400
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'HEIGHT OF ROTOR SYSTEM (FT)$',100,0.,-.75)
      GO TO 2710
400   IF (OPTION.NE.4.) GO TO 410
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'HEIGHT OF ROTOR SYSTEM (FT)$',100,-1.,0.)
      GO TO 2710
410   IF (OPTION.NE.5.) GO TO 420
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'HEIGHT OF ROTOR SYSTEM (FT)$',100,0.,-.75)
      GO TO 2710
420   IF (OPTION.NE.6.) GO TO 430
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'HEIGHT OF ROTOR SYSTEM (FT)$',100,-1.15,0.)
      GO TO 2710
430   IF (OPTION.NE.7.) GO TO 440
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
440   CONTINUE
      GO TO 2700
450   IF (Z.NE.6.) GO TO 540
      DO 460 I=1,8
      X(I)=RPM(I)
```

```
460   CONTINUE
      XORIG=0.
      XSTP=50.
      XMAX=600.
      CALL XINTAX
      CALL YINTAX
      IF (OPTICN.NE.1.) GO TO 470
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR SPEED (RPM)$',1CO)
      CALL XINTAX
      GO TO 2710
470   IF (OPTICN.NE.2.) GO TO 480
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR SPEED (RPM)$',100)
      CALL YINTAX
      GO TO 2710
480   IF (OPTION.NE.3.) GO TO 490
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'MAIN ROTOR SPEED (RPM)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
490   IF (OPTICN.NE.4.) GO TC 500
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'MAIN ROTOR SPEED (RPM)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
500   IF (OPTION.NE.5.) GO TO 510
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAIN ROTOR SPEED (RPM)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
510   IF (OPTION.NE.6.) GO TC 520
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAIN ROTOR SPEED (RPM)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
520   IF (OPTION.NE.7.) GO TO 530
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
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530   CONTINUE
      GO TO 2700
540   IF (Z.NE.7.) GO TO 630
      DO 550 I=1,8
      X(I)=RPMTR(I)
550   CONTINUE
      XORIG=500.
      XSTP=500.
      XMAX=35C0.
      IF (OPTION.NE.1.) GO TO 560
      CALL XTICKS (5)
      CALL XNAME ('TAIL ROTOR SPEED (RPM)$',100)
      CALL XINTAX
      GO TO 2710
560   IF (OPTION.NE.2.) GO TO 570
      CALL YTICKS (5)
      CALL YNAME ('TAIL ROTOR SPEED (RPM)$',100)
      CALL YINTAX
      GO TO 2710
570   IF (OPTION.NE.3.) GO TC 580
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'TAIL ROTOR SPEED (RPM)$',100,C.,-.75)
      CALL XINTAX
      GO TO 2710
580   IF (OPTICN.NE.4.) GO TO 590
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'TAIL ROTOR SPEED (RPM)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
590   IF (OPTION.NE.5.) GO TC 600
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'TAIL ROTOR SPEED (RPM)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
600   IF (OPTICN.NE.6.) GO TO 610
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'TAIL ROTOR SPEED (RPM)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
610   IF (OPTION.NE.7.) GO TO 620
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      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
620   CONTINUE
      GO TO 2700
630   IF (Z.NE.8.) GO TO 720
      DO 640 I=1,8
      X(I)=C(I)
640   CONTINUE
      XORIG=0.0
      XSTP=0.5
      XMAX=3.0
      IF (OPTION.NE.1.) GO TO 650
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR BLADE CHORD(FT)$',100)
      GO TO 2710
650   IF (OPTION.NE.2.) GO TO 660
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR BLADE CHORD(FT)$',100)
      GO TO 2710
660   IF (OPTION.NE.3.) GO TO 670
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'MAIN ROTOR BLADE CHORD(FT)$',100,0.,-.75)
      GO TO 2710
670   IF (OPTION.NE.4.) GO TO 680
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'MAIN ROTOR BLADE CHORD(FT)$',100,-1.,0.)
      GO TO 2710
680   IF (OPTION.NE.5.) GO TO 690
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAIN ROTOR BLADE CHORD(FT)$',100,0.,-.75)
      GO TO 2710
690   IF (OPTION.NE.6.) GO TO 700
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAIN ROTOR BLADE CHORD(FT)$',100,-1.15,0.)
      GO TO 2710
700   IF (OPTION.NE.7.) GO TO 710
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
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710   CONTINUE
      GO TO 2700
720   IF (Z.NE.9.) GO TO 810
      DO 730 I=1,8
      X(I)=CTR(I)
730   CONTINUE
      XORIG=0.3
      XSTP=0.1
      XMAX=1.5
      IF (OPTION.NE.1.) GO TO 740
      CALL XTICKS (5)
      CALL XNAME ('TAIL ROTOR BLADE CHORD(FT)$',100)
      GO TO 2710
740   IF (OPTION.NE.2.) GO TO 750
      CALL YTICKS (5)
      CALL YNAME ('TAIL ROTOR BLADE CHORD(FT)$',100)
      GO TO 2710
750   IF (OPTION.NE.3.) GO TO 760
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'TAIL ROTOR BLADE CHORD(FT)$',100,0.,-.75)
      GO TO 2710
760   IF (OPTION.NE.4.) GO TO 770
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'TAIL ROTOR BLADE CHORD(FT)$',100,-1.,0.)
      GO TO 2710
770   IF (OPTICN.NE.5.) GO TC 780
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'TAIL ROTOR BLADE CHORD(FT)$',100,0.,-.75)
      GO TO 2710
780   IF (OPTION.NE.6.) GO TC 790
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'TAIL ROTOR BLADE CHORD(FT)$',100,-1.15,0.)
      GO TO 2710
790   IF (OPTION.NE.7.) GO TO 800
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
800   CONTINUE
      GO TO 2700
810   IF (Z.NE.10.) GO TO 900
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      DO 820 I=1,8
      X(I)=RS(I)
820   CONTINUE
      XORIG=10.
      XSTP=5.
      XMAX=40.
      IF (OPTION.NE.1.) GO TO 830
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR BLADE  SPAN(FT)$',100)
      GO TO 2710
830   IF (OPTICN.NE.2.) GC TC 840
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR BLADE  SPAN(FT)$',100)
      GO TO 2710
840   IF (OPTION.NE.3.) GO TO 850
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'MAIN ROTOR BLADE SPAN(FT)$',100,0.,-.75)
      GO TO 2710
850   IF (OPTION.NE.4.) GO TO 860
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'MAIN ROTOR BLADE SPAN(FT)$',100,-1.,0.)
      GO TO 2710
860   IF (OPTION.NE.5.) GC TC 870
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAIN ROTOR BLADE SPAN(FT)$',1C0,0.,-.75)
      GO TO 2710
870   IF (OPTION.NE.6.) GO TC 880
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAIN ROTOR BLADE SPAN(FT)$',100,-1.15,0.)
      GO TO 2710
880   IF (OPTION.NE.7.) GO TO 890
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
890   CONTINUE
      GO TO 2700
900   IF (Z.NE.11.) GO TO 990
      DO 910 I=1,8
      X(I)=RSTR(I)
910   CONTINUE
```

```
      XORIG=0.
      XSTP=1.
      XMAX=10.
      IF (OPTION.NE.1.) GO TO 920
      CALL XTICKS (5)
      CALL XNAME ('TAIL ROTOR BLADE SPAN(FT)$',100)
      GO TO 2710
920   IF (OPTICN.NE.2.) GO TC 930
      CALL YTICKS (5)
      CALL YNAME ('TAIL ROTOR BLADE SPAN(FT)$',100)
      GO TO 2710
930   IF (OPTION.NE.3.) GO TO 940
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'TAIL ROTOR BLADE SPAN(FT)$',100,0.,-.75)
      GO TO 2710
940   IF (OPTION.NE.4.) GO TO 950
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'TAIL ROTOR BLADE SPAN(FT)$',100,-1.,0.)
      GO TO 2710
950   IF (OPTICN.NE.5.) GO TC 960
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'TAIL ROTOR BLADE SPAN(FT)$',1C0,0.,-.75)
      GO TO 2710
960   IF (OPTION.NE.6.) GO TC 970
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'TAIL ROTOR BLADE SPAN(FT)$',100,-1.15,0.)
      GO TO 2710
970   IF (OPTION.NE.7.) GO TO 980
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
980   CONTINUE
      GO TO 2700
990   IF (Z.NE.12.) GO TO 1080
      DO 1000 I=1,8
      X(I)=TWST(I)
1000  CONTINUE
      XORIG=-5.
      XSTP=-5.
      XMAX=-20.
```

```
      IF (OPTION.NE.1.) GO TO 1010
      CALL XTICKS (5)
      CALL XNAME ('MAIN ROTOR BLADE TWIST(DEG)$',100)
      GO TO 2710
1010  IF (OPTION.NE.2.) GO TO 1020
      CALL YTICKS (5)
      CALL YNAME ('MAIN ROTOR BLADE TWIST(DEG)$',100)
      GO TO 2710
1020  IF (OPTION.NE.3.) GO TO 1030
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'MAIN ROTOR BLADE TWIST(DEG)$',100,0.,-.75)
      GO TO 2710
1030  IF (OPTION.NE.4.) GO TO 1040
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'MAIN ROTOR BLADE TWIST(DEG)$',100,-1.,0.)
      GO TO 2710
1040  IF (OPTION.NE.5.) GO TO 1050
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAIN ROTOR BLADE TWIST(DEG)$',100,0.,-.75)
      GO TO 2710
1050  IF (OPTION.NE.6.) GO TO 1060
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAIN ROTOR BLADE TWIST(DEG)$',100,-1.15,0.)
      GO TO 2710
1060  IF (OPTION.NE.7.) GO TO 1070
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
1070  CONTINUE
      GO TO 2700
1080  IF (Z.NE.13.) GO TO 1170
      DO 1090 I=1,8
      X(I)=TWSTTR(I)
1090  CONTINUE
      XORIG=5.
      XSTP=-5.
      XMAX=-20.
      IF (OPTION.NE.1.) GO TO 1100
      CALL XTICKS (5)
      CALL XNAME ('TAIL ROTOR BLADE TWIST(DEG)$',100)
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      GO TO 2710
1100  IF (OPTION.NE.2.) GO TO 1110
      CALL YTICKS (5)
      CALL YNAME ('TAIL ROTOR BLADE TWIST(DEG)$',100)
      GO TO 2710
1110  IF (OPTION.NE.3.) GO TO 1120
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'TAIL ROTOR BLADE TWIST(DEG)$',100,0.,-.75)
      GO TO 2710
1120  IF (OPTION.NE.4.) GO TO 1130
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'TAIL ROTOR BLADE TWIST(DEG)$',100,-1.,0. )
      GO TO 2710
1130  IF (OPTION.NE.5.) GO TO 1140
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'TAIL ROTOR BLADE TWIST(DEG)$',100,0.,-.75)
      GO TO 2710
1140  IF (OPTION.NE.6.) GO TO 1150
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'TAIL ROTOR BLADE TWIST(DEG)$',100,-1.15,0.)
      GO TO 2710
1150  IF (OPTION.NE.7.) GO TO 1160
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
1160  CONTINUE
      GO TO 2700
1170  IF (Z.NE.14.) GO TO 1260
      DO 1180 I=1,8
      X(I)=CCC(I)
1180  CONTINUE
      XORIG=.007
      XSTP=.001
      XMAX=.011
      IF (OPTION.NE.1.) GO TO 1190
      CALL XTICKS (5)
      CALL XNAME ('PROFILE DRAG MAIN ROTOR$',100)
      GO TO 2710
1190  IF (OPTION.NE.2.) GO TO 1200
      CALL YTICKS (5)
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      CALL YNAME ('PROFILE DRAG MAIN ROTCR$',100)
      GO TO 2710
1200  IF (OPTION.NE.3.) GO TC 1210
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'PROFILE DRAG MAIN ROTOR$',100,0.,-.75)
      GO TO 2710
1210  IF (OPTION.NE.4.) GO TO 1220
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'PROFILE DRAG MAIN ROTOR$',100,-1.,0.)
      GO TO 2710
1220  IF (OPTION.NE.5.) GO TO 1230
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'PROFILE DRAG MAIN ROTOR$',100,0.,-.75)
      GO TO 2710
1230  IF (OPTICN.NE.6.) GO TO 1240
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'PROFILE DRAG MAIN ROTCR$',100,-1.15,0.)
      GO TO 2710
1240  IF (OPTION.NE.7.) GO TC 1250
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
1250  CONTINUE
      GO TO 2700
1260  IF (Z.NE.15.) GO TO 1350
      DO 1270 I=1,8
      X(I)=CDCTR(I)
1270  CONTINUE
      XORIG=.007
      XSTP=.CO2
      XMAX=.017
      IF (OPTICN.NE.1.) GO TO 1280
      CALL XTICKS (2)
      CALL XNAME ('PROFILE DRAG TAIL ROTOR$',100)
      GO TO 2710
1280  IF (OPTION.NE.2.) GO TO 1290
      CALL YTICKS (2)
      CALL YNAME ('PROFILE DRAG TAIL ROTCR$',100)
      GO TO 2710
1290  IF (OPTION.NE.3.) GO TO 1300
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      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1           'PROFILE DRAG TAIL ROTOR$',100,0.,-.75)
      GO TO 2710
 1300 IF (OPTION.NE.4.) GO TC 1310
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1           'PROFILE DRAG TAIL ROTOR$',100,-1.,0.)
      GO TO 2710
 1310 IF (OPTION.NE.5.) GO TO 1320
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1           'PROFILE DRAG TAIL ROTOR$',100,0.,-.75)
      GO TO 2710
 1320 IF (OPTION.NE.6.) GO TO 1330
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1           'PROFILE DRAG TAIL ROTOR$',100,-1.15,0.)
      GO TO 2710
 1330 IF (OPTION.NE.7.) GC TC 1340
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
 1340 CONTINUE
      GO TO 2700
 1350 IF (Z.NE.16.) GO TO 1440
      DO 1360 I=1,8
      X(I)=DL(I)
 1360 CONTINUE
      XORIG=4.
      XSTP=1.
      XMAX=16.
      IF (OPTION.NE.1.) GO TO 1370
      CALL XTICKS (2)
      CALL XNAME ('DISC LOADING$',100)
      GO TO 2710
 1370 IF (OPTION.NE.2.) GO TO 1380
      CALL YTICKS (2)
      CALL YNAME ('DISC LOADING$',100)
      GO TO 2710
 1380 IF (OPTION.NE.3.) GO TO 1390
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
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     1                'DISC LOADING$',100,0.,-.75)
      GO TO 2710
1390  IF (OPTION.NE.4.) GO TO 1400
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1                'DISC LOADING$',100,-1.,0.)
      GO TO 2710
1400  IF (OPTION.NE.5.) GO TO 1410
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1                'DISC LOADING$',100,0.,-.75)
      GO TO 2710
1410  IF (OPTICN.NE.6.) GO TO 1420
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                'DISC LOADING$',100,-1.15,0.)
      GO TO 2710
1420  IF (OPTICN.NE.7.) GO TC 1430
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1430  CONTINUE
      GO TO 2700
1440  IF (Z.NE.17.) GO TO 1530
      DO 1450 I=1,8
      X(I)=WDT(I)
1450  CONTINUE
      XORIG=2.
      XSTP=1.
      XMAX=10.
      IF (OPTION.NE.1.) GO TO 1460
      CALL XTICKS (2)
      CALL XNAME ('FUSELAGE WIDTH (FT)$',100)
      GO TO 2710
1460  IF (OPTICN.NE.2.) GO TC 1470
      CALL YTICKS (2)
      CALL YNAME ('FUSELAGE WIDTH (FT)$',100)
      GO TO 2710
1470  IF (OPTICN.NE.3.) GO TO 1480
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                'FUSELAGE WIDTH (FT)$',100,0.,-.75)
      GO TO 2710
1480  IF (OPTICN.NE.4.) GO TO 1490
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      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'FUSELAGE WIDTH (FT)$',100,-1.,0.)
      GO TO 2710
1490  IF (OPTION.NE.5.) GO TO 1500
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'FUSELAGE WIDTH (FT)$',100,0.,-.75)
      GO TO 2710
1500  IF (OPTION.NE.6.) GO TO 1510
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'FUSELAGE WIDTH (FT)$',100,-1.15,0.)
      GO TO 2710
1510  IF (OPTION.NE.7.) GO TO 1520
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1520  CONTINUE
      GO TO 2700
1530  IF (Z.NE.18.) GO TO 1620
      DO 1540 I=1,8
      X(I)=LGH(I)
1540  CONTINUE
      XORIG=20.
      XSTP=20.
      XMAX=120.
      IF (OPTION.NE.1.) GO TO 1550
      CALL XTICKS (2)
      CALL XNAME ('FUSELAGE LENGTH (FT)$',100)
      GO TO 2710
1550  IF (OPTION.NE.2.) GO TO 1560
      CALL YTICKS (2)
      CALL YNAME ('FUSELAGE LENGTH (FT)$',100)
      GO TO 2710
1560  IF (OPTION.NE.3.) GO TO 1570
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'FUSELAGE LENGTH (FT)$',100,0.,-.75)
      GO TO 2710
1570  IF (OPTION.NE.4.) GO TO 1580
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
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     1                'FUSELAGE LENGTH (FT)$',100,-1.,0.)
      GO TO 2710
1580  IF (OPTION.NE.5.) GO TO 1590
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1                'FUSELAGE LENGTH (FT)$',100,0.,-.75)
      GO TO 2710
1590  IF (OPTION.NE.6.) GO TO 1600
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                'FUSELAGE LENGTH (FT)$',100,-1.15,0.)
      GO TO 2710
1600  IF (OPTION.NE.7.) GO TO 1610
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1610  CONTINUE
      GO TO 2700
1620  IF (Z.NE.19.) GO TO 1710
      DO 1630 I=1,8
      X(I)=FH(I)
1630  CONTINUE
      XORIG=0.
      XSTP=10.
      XMAX=70.
      IF (OPTION.NE.1.) GO TO 1640
      CALL XTICKS (2)
      CALL XNAME ('FRONT FLAT PLATE AREA(SF)$',100)
      GO TO 2710
1640  IF (OPTION.NE.2.) GO TO 1650
      CALL YTICKS (2)
      CALL YNAME ('FRONT FLAT PLATE AREA(SF)$',100)
      GO TO 2710
1650  IF (OPTION.NE.3.) GO TO 1660
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                'FRONT FLAT PLATE AREA(SF)$',100,0.,-.75)
      GO TO 2710
1660  IF (OPTION.NE.4.) GO TO 1670
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1                'FRONT FLAT PLATE AREA(SF)$',100,-1.,0.)
      GO TO 2710
1670  IF (OPTION.NE.5.) GO TO 1680
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      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'FRONT FLAT PLATE AREA(SF)$',100,0.,-.75)
      GO TO 2710
1680  IF (OPTION.NE.6.) GO TO 1690
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'FRONT FLAT PLATE AREA(SF)$',100,-1.15,0. )
      GO TO 2710
1690  IF (OPTION.NE.7.) GO TO 1700
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1700  CONTINUE
      GO TO 2700
1710  IF (Z.NE.20.) GO TO 1800
      DO 1720 I=1,8
      X(I)=FV(I)
1720  CONTINUE
      XORIG=0.
      XSTP=30.
      XMAX=150.
      IF (OPTION.NE.1.) GO TO 1730
      CALL XTICKS (3)
      CALL XNAME ('VERT. FLAT PLATE AREA(SF)$',100)
      GO TO 2710
1730  IF (OPTION.NE.2.) GO TO 1740
      CALL YTICKS (3)
      CALL YNAME ('VERT. FLAT PLATE AREA(SF)$',100)
      GO TO 2710
1740  IF (OPTION.NE.3.) GO TO 1750
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'VERT. FLAT PLATE AREA(SF)$',100,0.,-.75)
      GO TO 2710
1750  IF (OPTION.NE.4.) GO TO 1760
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'VERT. FLAT PLATE AREA(SF)$',100,-1.,0.)
      GO TO 2710
1760  IF (OPTION.NE.5.) GO TO 1770
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
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     1                'VERT. FLAT PLATE AREA(SF)$',100,0.,-.75)
      GO TO 2710
1770  IF (OPTION.NE.6.) GO TO 1780
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                'VERT. FLAT PLATE AREA(SF)$',100,-1.15,0.)
      GO TO 2710
1780  IF (OPTION.NE.7.) GO TO 1790
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
1790  CONTINUE
      GO TO 2700
1800  IF (Z.NE.21.) GO TO 1890
      DO 1810 I=1,8
      X(I)=VM(I)
1810  CONTINUE
      XORIG=100.
      XSTP=10.
      XMAX=180.
      IF (OPTION.NE.1.) GO TO 1820
      CALL XTICKS (2)
      CALL XNAME ('MAXIMUM VELOCITY (KNT)$',100)
      CALL XINTAX
      GO TO 2710
1820  IF (OPTION.NE.2.) GO TO 1830
      CALL YTICKS (2)
      CALL YNAME ('MAXIMUM VELOCITY (KNT)$',100)
      CALL YINTAX
      GO TO 2710
1830  IF (OPTION.NE.3.) GO TO 1840
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                'MAXIMUM VELOCITY (KNT)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
1840  IF (OPTION.NE.4.) GO TO 1850
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1                'MAXIMUM VELOCITY (KNT)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
1850  IF (OPTION.NE.5.) GO TO 1860
      CALL XTICKS (2)
      CALL XREVTK
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      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAXIMUM VELOCITY (KNT)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
1860  IF (OPTION.NE.6.) GO TO 1870
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAXIMUM VELOCITY (KNT)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
1870  IF (OPTION.NE.7.) GO TO 1880
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1880  CONTINUE
      GO TO 450
1890  IF (Z.NE.22.) GO TO 1980
      DO 1900 I=1,8
      X(I)=RNG(I)
1900  CONTINUE
      XORIG=150.
      XSTP=50.
      XMAX=550.
      IF (OPTION.NE.1.) GO TO 1910
      CALL XTICKS (2)
      CALL XNAME ('MAXIMUM RANGES (NM)$',100)
      CALL XINTAX
      GO TO 2710
1910  IF (OPTION.NE.2.) GO TC 1920
      CALL YTICKS (2)
      CALL YNAME ('MAXIMUM RANGES (NM)$',100)
      CALL YINTAX
      GO TO 2710
1920  IF (OPTICN.NE.3.) GO TC 1930
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'MAXIMUM RANGE (NM))
      CALL XINTAX
      GO TO 2710
1930  IF (OPTION.NE.4.) GO TO 1940
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'MAXIMUM RANGE (NM))
      CALL YINTAX
      GO TO 2710
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1940  IF (OPTION.NE.5.) GO TO 1950
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'MAXIMUM RANGE (NM)')
      CALL XINTAX
      GO TO 2710
1950  IF (OPTION.NE.6.) GO TO 1960
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'MAXIMUM RANGE (NM)')
      CALL YINTAX
      GO TO 2710
1960  IF (OPTION.NE.7.) GO TO 1970
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
1970  CONTINUE
      GO TO 2700
1980  IF (Z.NE.23.) GO TO 2070
      DO 1990 I=1,8
      X(I)=RC(I)
1990  CONTINUE
      XORIG=0.
      XSTP=500.
      XMAX=3000.
      IF (OPTION.NE.1.) GO TO 2000
      CALL XTICKS (2)
      CALL XNAME ('RATE OF CLIMB (FT/MIN)$',100)
      CALL XINTAX
      GO TO 2710
2000  IF (OPTION.NE.2.) GO TO 2010
      CALL YTICKS (2)
      CALL YNAME ('RATE OF CLIMB (FT/MIN)$',100)
      CALL YINTAX
      GO TO 2710
2010  IF (OPTION.NE.3.) GO TO 2020
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'RATE OF CLIMB (FT/MIN)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2020  IF (OPTION.NE.4.) GO TO 2030
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
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```
     1                 'RATE OF CLIMB (FT/MIN)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2030  IF (OPTION.NE.5.) GO TO 2040
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1                 'RATE OF CLIMB (FT/MIN)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2040  IF (OPTION.NE.6.) GO TO 2050
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                 'RATE OF CLIMB (FT/MIN)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2050  IF (OPTICN.NE.7.) GO TO 2060
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
2060  CONTINUE
      GO TO 2700
2070  IF (Z.NE.24.) GC TO 2160
      DO 2080 I=1,8
      X(I)=HCVIGE(I)
2080  CONTINUE
      XORIG=3000.
      XSTP=3000.
      XMAX=15C00.
      IF (OPTION.NE.1.) GO TO 2090
      CALL XTICKS (3)
      CALL XNAME ('HOVER CEILING (FT) IGE$',100)
      CALL XINTAX
      GO TO 2710
2090  IF (OPTION.NE.2.) GO TO 2100
      CALL YTICKS (3)
      CALL YNAME ('HOVER CEILING (FT) IGE$',100)
      CALL YINTAX
      GO TO 2710
2100  IF (OPTION.NE.3.) GO TO 2110
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                 'HOVER CEILING (FT) IGE$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2110  IF (OPTICN.NE.4.) GO TC 2120
```

```
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'HOVER CEILING (FT) IGE$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2120  IF (OPTICN.NE.5.) GO TO 2130
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'HOVER CEILING (FT) IGE$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2130  IF (OPTION.NE.6.) GO TO 2140
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'HOVER CEILING (FT) IGE$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2140  IF (OPTICN.NE.7.) GO TO 2150
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
2150  CONTINUE
      GO TO 2700
2160  IF (Z.NE.25.) GO TO 2250
      DO 2170 I=1,8
      X(I)=HCVOGE(I)
2170  CONTINUE
      XORIG=0.
      XSTP=3CC0.
      XMAX=18000.
      IF (OPTICN.NE.1.) GO TO 2180
      CALL XTICKS (3)
      CALL XNAME ('HOVER CEILING (FT) OGE$',100)
      CALL XINTAX
      GO TO 2710
2180  IF (OPTION.NE.2.) GO TO 2190
      CALL YTICKS (3)
      CALL YNAME ('HOVER CEILING (FT) OGE$',100)
      CALL YINTAX
      GO TO 2710
2190  IF (OPTION.NE.3.) GO TO 2200
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'HOVER CEILING (FT) OGE$',100,0.,-.75)
```

```
      CALL XINTAX
      GO TO 2710
 2200 IF (OPTION.NE.4.) GO TO 2210
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'HOVER CEILING (FT) OGE$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
 2210 IF (OPTICN.NE.5.) GO TC 2220
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'HOVER CEILING (FT) OGE$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
 2220 IF (OPTION.NE.6.) GO TO 2230
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'HOVER CEILING (FT) OGE$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
 2230 IF (OPTION.NE.7.) GO TO 2240
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
 2240 CONTINUE
      GO TO 2700
 2250 IF (Z.NE.26.) GO TO 2340
      DO 2260 I=1,8
      X(I)=LT(I)
 2260 CONTINUE
      XORIG=10.
      XSTP=10.
      XMAX=60.
      IF (OPTICN.NE.1.) GO TO 2270
      CALL XTICKS (5)
      CALL XNAME ('LENGTH OF TAIL (FT)$',100)
      GO TO 2710
 2270 IF (OPTION.NE.2.) GO TO 2280
      CALL YTICKS (5)
      CALL YNAME ('LENGTH OF TAIL (FT)$',100)
      GO TO 2710
 2280 IF (OPTICN.NE.3.) GO TC 2290
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
```

```
     1                'LENGTH OF TAIL (FT)$',100,0.,-.75)
      GO TO 2710
 2290 IF (OPTION.NE.4.) GO TO 2300
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1                'LENGTH OF TAIL (FT)$',100,-1.,0.)
      GO TO 2710
 2300 IF (OPTION.NE.5.) GO TO 2310
      CALL XTICKS (5)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1                'LENGTH OF TAIL (FT)$',100,0.,-.75)
      GO TO 2710
 2310 IF (OPTION.NE.6.) GO TO 2320
      CALL YTICKS (5)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1                'LENGTH OF TAIL (FT)$',100,-1.15,0.)
      GO TO 2710
 2320 IF (OPTION.NE.7.) GO TO 2330
      CALL XTICKS (5)
      CALL XNAME (' ',1)
      GO TO 2710
 2330 CONTINUE
      GO TO 2700
 2340 IF (Z.NE.27.) GO TO 2430
      DO 2350 I=1,8
      X(I)=OWT(I)
 2350 CONTINUE
      XORIG=0.
      XSTP=5000.
      XMAX=40000.
      IF (OPTION.NE.1.) GO TO 2360
      CALL XTICKS (2)
      CALL XNAME ('OPERATING WEIGHT (LB)$',100)
      CALL XINTAX
      GO TO 2710
 2360 IF (OPTION.NE.2.) GO TO 2370
      CALL YTICKS (2)
      CALL YNAME ('OPERATING WEIGHT (LB)$',100)
      CALL YINTAX
      GO TO 2710
 2370 IF (OPTION.NE.3.) GO TO 2380
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1                'OPERATING WEIGHT (LB)$',100,0.,-.75)
```

```
      CALL XINTAX
      GO TO 2710
2380  IF (OPTION.NE.4.) GO TO 2390
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'OPERATING WEIGHT (LB)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2390  IF (OPTION.NE.5.) GO TO 2400
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'OPERATING WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2400  IF (OPTICN.NE.6.) GO TO 2410
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'OPERATING WEIGHT (LB)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2410  IF (OPTICN.NE.7.) GO TO 2420
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
2420  CONTINUE
      GO TO 2700
2430  IF (Z.NE.28.) GO TO 2520
      DO 2440 I=1,8
      X(I)=LWT(I)
2440  CONTINUE
      XORIG=0.
      XSTP=5000.
      XMAX=30000.
      IF (OPTICN.NE.1.) GO TO 2450
      CALL XTICKS (2)
      CALL XNAME ('LOAD WEIGHT (LB)$',100)
      CALL XINTAX
      GO TO 2710
2450  IF (OPTION.NE.2.) GO TO 2460
      CALL YTICKS (2)
      CALL YNAME ('LOAD WEIGHT (LB)$',100)
      CALL YINTAX
      GO TO 2710
2460  IF (OPTICN.NE.3.) GO TO 2470
      CALL XTICKS (2)
```

```
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'LOAD WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2470  IF (OPTION.NE.4.) GO TO 2480
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'LOAD WEIGHT (LB)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2480  IF (OPTION.NE.5.) GO TO 2490
      CALL XTICKS (2)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'LOAD WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2490  IF (OPTION.NE.6.) GO TO 2500
      CALL YTICKS (2)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'LOAD WEIGHT (LB)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2500  IF (OPTION.NE.7.) GO TC 2510
      CALL XTICKS (2)
      CALL XNAME (' ',1)
      GO TO 2710
2510  CONTINUE
      GO TO 27C0
2520  IF (Z.NE.29.) GO TO 2610
      DO 2530 I=1,8
      X(I)=FWT(I)
2530  CONTINUE
      XORIG=C.
      XSTP=30C0.
      XMAX=21000.
      IF (OPTION.NE.1.) GO TO 2540
      CALL XTICKS (3)
      CALL XNAME ('FUEL WEIGHT (LB)$',100)
      CALL XINTAX
      GO TO 2710
2540  IF (OPTION.NE.2.) GO TO 2550
      CALL YTICKS (3)
      CALL YNAME ('FUEL WEIGHT (LB)$',100)
      CALL YINTAX
```

```
      GO TO 2710
2550  IF (OPTION.NE.3.) GO TO 2560
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1            'FUEL WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2560  IF (OPTION.NE.4.) GO TO 2570
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1            'FUEL WEIGHT (LB)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2570  IF (OPTION.NE.5.) GO TO 2580
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1            'FUEL WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2580  IF (OPTION.NE.6.) GO TO 2590
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1            'FUEL WEIGHT (LB)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2590  IF (OPTION.NE.7.) GO TO 2600
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
2600  CONTINUE
      GO TO 2700
2610  IF (Z.NE.30.) GO TO 2700
      DO 2620 I=1,8
      X(I)=MGW(I)
2620  CONTINUE
      XORIG=0.
      XSTP=30000.
      XMAX=90000.
      IF (OPTION.NE.1.) GO TO 2630
      CALL XTICKS (3)
      CALL XNAME ('MAXIMUM GROSS WEIGHT (LB)$',100)
      CALL XINTAX
      GO TO 2710
2630  IF (OPTION.NE.2.) GO TO 2640
```

```
      CALL YTICKS (3)
      CALL YNAME ('MAXIMUM GROSS WEIGHT (LB)$',100)
      CALL YINTAX
      GO TO 2710
2640  IF (OPTION.NE.3.) GO TO 2650
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,9.,
     1             'MAXIMUM GROSS WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2650  IF (OPTION.NE.4.) GO TO 2660
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,6.,
     1             'MAXIMUM GROSS WEIGHT (LB)$',100,-1.,0.)
      CALL YINTAX
      GO TO 2710
2660  IF (OPTION.NE.5.) GO TO 2670
      CALL XTICKS (3)
      CALL XREVTK
      CALL XGRAXS (XORIG,XSTP,XMAX,6.5,
     1             'MAXIMUM GROSS WEIGHT (LB)$',100,0.,-.75)
      CALL XINTAX
      GO TO 2710
2670  IF (OPTION.NE.6.) GO TO 2680
      CALL YTICKS (3)
      CALL YREVTK
      CALL YGRAXS (XORIG,XSTP,XMAX,8.,
     1             'MAXIMUM GROSS WEIGHT (LB)$',100,-1.15,0.)
      CALL YINTAX
      GO TO 2710
2680  IF (OPTION.NE.7.) GO TO 2690
      CALL XTICKS (3)
      CALL XNAME (' ',1)
      GO TO 2710
2690  CONTINUE
      GO TO 2700
2700  CONTINUE
      WRITE (6,2720)
2710  CONTINUE
      CALL RESET ('XREVTK')
      CALL RESET ('YREVTK')
      RETURN
2720  FORMAT (54H YOU HAVE MADE A MISTAKE AND ENTERED AN INVALID NUMBER)
      END
```

APPENDIX B

A. USERS GUIDE TO THE CONCEPTUAL DESIGN PROGRAM

The design program has been developed with the user in mind. The program is completely interactive in that it prompts the user for any inputs needed. The following steps should be taken to invoke the program and to get an output file useable for analysis.

1. Logon as normal on either the IBM 3278 or the Tektronix 618 dual screen system

2. Obtain temporary storage space by typing in:

   DEFINE STORAGE 1M (enter)

3. When PSW '00020000 00000000' appears on the screen type in:

   I CMS (enter)

4. If the program has not been compiled on your disk yet type in the following:

   FORTGI DESIGN (enter)

5. After the program has been compiled you are ready to run the program by typing in:

   DISSPLA (enter)

6. You will be asked to enter library functions or to press enter. Press the enter key.

7. You will then be asked if you want additional temporary space for shading, etc.. Again, press the enter key.

8. Next you will be asked to enter any defined files that you want. Here you should enter the following:

FILEDEF 08 DISK DESIGN (file name)

9. After entering the above line the screen will flash and your FILEDEF should be listed on the bottom line of the existing FILEDEFS. If your filedef is listed press the enter key to start the program execution.

10. Follow the instructions given on the screen. You will need the Helicopter Design Manual and the appropriate handouts/references to complete the process.

11. If you are on the IBM 3278 terminal you will not get a graph, therefore, you must plot the total power data by hand and extrapolate the needed data

12. If you are using the TEK 618 dual screen system a graph will be drawn of the total power curve and its components at altitude which can immediately be used to extrapolate the necessary data to complete the entire design process.

13. Note that the output file of all the information that you have computed is in the file that you have defined. To get your data type in:

PRINT DESIGN (filename) (CC

B. PROGRAM NOMENCLATURE

MNEMOMIC	DEFINITION
A	Sonic speed at standard sea level
AALT	Sonic speed at specification density altitude
AASLY	Average aircraft serviceable life in years
AFHPF	Average flight hours per flight
AFHPY	Average flight hours per year per airframe
ALPHA	Ordinate intercept of fuel flow-horsepower curve
ALT	Maximum rate of climb calculation altitude
ALTSC	Service ceiling altitude
AMAX	Steady flow stall angle of the airfoil

ANS	General variable for keyboard answer
AR	Aspect ratio of the main rotor system
AREAMR	Area of the main rotor disc
AREATR	Area of the tail rotor disc
ARTR	Aspect ratio of the tail rotor
ARVS	Vertical stabilizer aspect ratio
AVAIL	Availability of an engine
AVAILM	Availability (multiple engine)
A11	Term in definition of THETA2
A12	Term in definition of THETA2
A13	Term in definition of THETA2
A14	Term in definition of THETA2
A80	Vertical stabilizer angle of attack at 80 knots
A90	Angle of attack of the advancing blade (radians)
A160	Vertical stabilizer angle of attack at 160 knots
A90D	Angle of attack of the advancing blade (degrees)
A270	Angle of attack of retreating blade (radians)
A270D	Angle of attack of retreating blade (degrees)
B	Main rotor tip loss factor
BETA	Slope of the fuel flow horsepower curve
BH	Main rotor tip loss factor at a hover
BL	Blade loading of the main rotor system
BLADES	Number of main rotor blades

BLADTR	Number of tail rotor blades
BS	Term used in inboard stall analysis
BTA	Tail rotor tip loss factor at altitude
BTR	Tail rotor tip loss factor
BVS	Span of the vertical stabilizer
CDO	Coefficient of drag of a main rotor blade
CDOTR	Coefficient of drag of a tail rotor blade
CHORD	Chord of a main rotor blade
CHORDT	Chord of a tail rotor blade
CL	Coefficient of lift of a main rotor blade section
CLA	Lift curve slope of a main rotor blade section
CLMAX	Maximum coefficient of lift for a blade section
CL80	Section coefficient of lift at 80 knots
CL160	Section coefficient of lift at 160 knots
COLL	Collective position (radians)
COLLD	Collective position (degrees)
COMPAR	Weight variance parameter
CONST	Constant value in ICAO formulae
COUNT	Counter variable
CPC	Correction to power coefficient
CPS	Correction to power coefficient due to stall
CREW	Number of specified crew
CS	Term used in stall analysis

CT	Main rotor coefficient of thrust
CTH	Main rotor coefficient of thrust at a hover
CTTA	Tail rotor coefficient of thrust at altitude
CTTR	Tail rotor coefficient of thrust at sea level
CYCD	Cyclic position (degrees)
CYCLIC	Cyclic position (radians)
C1	Cost of main rotor
C2A	Cost of tail rotor
C2B	Cost of tail rotor structure
C3	Cost of body
C4	Cost of landing gear
C5	Cost of nacelle
C6A	Cost of engine
C6B	Cost of drive system
C6C	Cost of fuel tanks
C7	Cost of flight controls
C8	Cost of auxillary power
C9	Cost of instruments
C10	Cost of hydraulics
C11	Cost of electrical system
C12	Cost of avionics
C13	Cost of furnishings
C14	Cost of air and ice

C15	Cost of load and handling
D	Diameter of the rotor system
DA270	Blade angle of advancing blade (degrees)
DELTA	Fuel flow ratio
DERR	Error function
DL	Disc loading of the main rotor system
DLAMB	Term used in blade stall analysis
DP	Parasite drag
DREF	Acceptable error function
DW	Powerplant dry weight of an engine
DWG	Design gross weight
DWM	Powerplant dry weight (multiple engine)
D1	Stall analysis parameter
D2	Stall analysis parameter
EFPAFF	Effective flat plate area (horizontal)
EFPAVF	Effective flat plate area (vertical)
EIW	Engine installed weight
EIWM	Engine installed weight (multiple engine)
ENGSEL	Engine selected
ESHPR	Estimated shaft horsepower required to hover
EW	Estimated engine weight from weight estimations
EWNEW	New engine weight using powerplant data
EXCESS	Excess weight

E1	Stall analysis parameter
E2	Stall analysis parameter
E3	Stall analysis parameter
FL	Factor for landing gear weight approximation
FSLT	Length of the fuselage
FSLTS	Specification maximum length of the fuselage
FUEL	Amount of fuel in pounds
FW	Fuel weight in pounds
FWNEW	Change in original fuel weight for printout
GALIN	Internal fuel weight in gallons
GALOUT	External fuel weight in gallons
GAM	Stall analysis parameter
GWSPEC	Specification maximum gross weight
HL	Life of the aircraft
HOVIGE	Specification hover ceiling (in ground effect)
HP	Hover power of the main rotor sysem (out of ground effect)
ht	Rotor system height above the ground
I	Do loop parameter
IC	Initial cost of an engine
ICM	Initial costs (multiple engine)
IER	Library function error code
IF	Installation fraction
IHP	Array for plotting

IR	Inflation rate in 1977 dollars
K	Dc lcop parameter
KNOTS	Increment for forward speed
KNT	Increment for forward speed
KNTS	Knots increment for table
KS	Stall analysis parameter
LAMBDA	Stall analysis parameter
LAMB1	Stall analysis parameter
LAMFR	Used for reliability calculation
LCC	Life cycle cost of an engine
LCCM	Life cycle cost (multiple engine)
LERR	Acceptable error function
LG	Type of landing gear
LOAD	Loading used to find effective flat plate area
LREF	Acceptable error function
LTR	Length of the tail rotor
M	Figure of merit
MACH	Maximum allowable Mach number at sea level
MACHT	Main rotor system tip Mach number
MAINT	Maintainability of an engine
MAINTM	Maintainability (multiple engine)
MAXRC	Specification rate of climb
MAXV	Maxium forward velocity in feet per second

MCRIT Critical Mach number

MCRO Zero angle of attack critical Mach number

MD Drag divergence Mach number

MDT Mean down time of an engine

MTBF Mean time between engine failures

MTBMA Mean time between maintenance actions per engine

MTBR Mean time between repairs for an engine

MTBRM Mean time between repair (multiple engine)

MTIP Tip Mach number of the main rotor system

MTTR TIP MACH NUMBER OF THE TAIL ROTOR SYSTEM

MU Advance ratio of the main rotor system

MUTR Advance ratio of the tail rotor system

N Do loop parameter

NDEG Order of differential equation

NENG Number of engines

NEWUSE New useful load

NN Do loop parameter

NRPL Number of engine replacements (real or integer)

NRPLM Number of engine replacements (multiple engine)

NW Number of landing gear

NXRPL Number of engine replacements (integer)

NXRPLM Number of engine replacements (multiple engine)

OC Operating cost of an engine

OLD	Previous gross weight used for comparison
OMEGA	Main rotor rotational velocity (radians)
OMEGTR	Tail rotor rotational velocity (radians)
PA	Specification pressure altitude
PADJA	Adjusted power at altitude
PADJS	Adjusted power at sea level
PALT	Rate of climb pressure
PAVAIL	Power available
PC	Power to climb
PCMPA	Array for compressible power at altitude
PCMPs	Array for compressible power at sea level
PEOPLE	Number of people
PI	Induced power of the main rotor system
PIE	Constant for value of pi
PIHP	Induced power of the main rotor system in HP
PITLF	Induced power (IGE) at a forward speed
PITLFA	Induced power at altitude at forward speed
PITLFS	Induced power at sea level at forward speed
PITLGE	Induced power in ground effect
PITLGH	Induced power at a hover
PITLH	Induced power at a hover
PITLTF	Induced power of the tail rotor in forward flight
PITLTR	Induced power for the tail rotor

PITRFA	Induced power of the tail rotor at altitude in forward flight
PITRFS	Induced power of the tail rotor at sea level in forward flight
PIVERT	Induced power vertically
PIX	Array used for plotting of total induced power at sea level
PIY	Array used for plotting total induced power at altitude
PM	Preventative maintenance cost of an engine
PMBS	Blade stall power factor
PO	Profile power of the main rotor system
POC	Profile power to climb
POF	Profile power at a forward speed
POFA	Profile power at altitude at forward speed
POFS	Profile power at sea level at forward speed
POH	Profile power at a hover
POHP	Profile power of the main rotor system in HP
POTA	Profile power of tail rotor at altitude
POTR	Profile power for the tail rotor
POTRF	Profile power of the tail rotor in forward flight
POTRFA	Profile power of the tail rotor at altitude in forward flight
POTRFS	Profile power of the tail rotor at sea level in forward flight
POX	Array used for plotting of total profile power at sea level
POY	Array used for plotting total profile power at altitude

PP	Parasite power
PPC	Parasite power to climb
PPF	Parasite power at a forward speed
PPFA	Parasite power at altitude at forward speed
PPFS	Parasite power at sea level at forward speed
PPOGE	In ground effect distance parameter
PPOGEH	Ground effect factor at a hover
PPX	Array used for plotting total parasite power at sea level
PPY	Array used for plotting total parasite power at altitude
PRESS	Specification pressure altitude
PS	Stall power
PSHP	Phantom shaft horsepower
PT	Total power of the main rotor system
PTACH	Total power for the aircraft to hover
PTAH	Total power of the aircraft to hover
PTAVAL	Total power available
PTF	Total power at a forward velocity
PTFA	Total power at altitude at forward speed
PTFS	Total power at sea level at forward speed
PTH	Total power at a hover
PTHOVS	Total power to hover
PTHP	Total power of the main rotor system in HP
PTTAHP	Total power of the aircraft to hover in HP

PTTRF	Total power of the tail rotor in forward flight
PTTRFA	Total power of the tail rotor at altitude in forward flight
PTTRFS	Total power of the tail rotor at sea level in forward flight
PTTRH	Total power for the tail rotor at a hover
PTTRHP	Total power for the tail rotor at a hover in HP
PTVERT	Total power vertically
PTX	Array used for plotting total power at sea level
PTY	Array used for plotting total power at altitude
Q	Production run quantity
R	Rotor radius
RBS	Retreating blade stall velocity
RC	Recovery cost of an engine
RCLIMB	Rate of climb
RCM	Recovery cost (multiple engine)
RDC	Research and development cost of an engine
RDCM	Research and development costs (multiple engine)
RELY	Reliability of an engine
RELYM	Reliability (multiple engine)
REVWE	Revised empty weight
REVWG	Revised gross weight
RHOALT	Density at specification density altitude
RHOMH	Density at hover in ground effect ceiling
RHOS	Density at service ceiling

RHOSC	Service ceiling density
RHOSL	Sea level density
RNGMAX	Maximum range as per specification
RNGNMX	New maximum range
RSHPC	Required shaft horsepower for cruise
RSHPME	Required shaft horsepower for max endurance speed
RSHRME	Total required shaft horsepower for max enduracne
RSHPRC	Total required shaft horsepower for cruise
RRSHP	Required shaft horsepower
RSHPM	Required shaft horsepower (military)
RSPEC	Specification maximum rotor radius
RT	Stall analysis parameter
RTR	Tail rotor radius
S	Main rotor planform area for weight estimation
SB	Body surface area for weight estimation
SC	Specification service ceiling
SFCC	Cruise specific fuel consumption
SFCM	Military specific fuel consumption
SFCN	Normal specific fuel consumption
SHPC	Cruise shaft horsepower
SHPM	Military shaft horsepower
SHPMM	Military shaft horsepower (multiple engine)
SHPN	Normal shaft horsepower

SIG	Pressure ratio
SIGMA	Solidity of the main rotor system
SIGTR	Solidity of the tail rotor system
SIM	Weight variance parameter
SPCLOD	Specification useful load
STEP	Variance parameter for iterations
STT	Total tail surface area for weight estimation
SV	Salvage value
SVM	Salvage value (multiple engine)
TALT	Rate of climb temperature
TEMP	Specification temperature
THETA	Temperature ratio
THETA0	Collective angle in radians
THETA2	Cyclic angle in radians
TOTALC	Total cost of an aircraft in a production run
TRIP1	Trips the program so that repetitive questions are repeated
TRIP2	Trips the program so that repetitive questions are repeated
TRIP3	Trips the program so that repetitive questions are repeated
TRIP4	Trips the program so that repetitive questions are repeated
TRIP5	Trips the program so that repetitive questions are repeated
TSHP	Total shaft horsepower
TTR	Thrust of the tail rotor

TTR80	Tail rotor thrust at 80 knots
TTR160	Tail rotor thrust at 160 knots
TWIST	Twist of main rotor blade
TYPE	Type of helicopter (light,medium,heavy)
TYPEM	Type of aircraft (light,medium,heavy)
T1	Term used in defining THETA0
T2	Term used in defining THETA0
T3	Term used in defining THETA0
T4	Term used in defining THETA0
USELOD	Useful load desired
VCR	Cruise velocity as per specification
VELMAX	Maximum forward velocity
VF	Forward velocity
VFWD	Forward velocity
VF80	Forward velocity at 80 knots in ft/sec
VF160	Forward velocity at 160 knots in ft/sce
VI	Induced velocity in a hover
VINEW	Induced velocity at hover
VIT	Vertical induced velocity at a hover
VITNEW	Induced vertical velocity at a hover
VITR	Induced velocity of the tail rotor
VITTR	Induced vertical velocity of the tail rotor
VL	stall parameter

VMAX	Specification maximum forward velocity
VMAXE	Maximum endurance velocity
VMAXF	Maximum forward velocity in knots
VMAXK	Initial forward velocity for stall analysis
VMAXR	Maximum range velocity
VOPT	Optimum velocity for aircraft in ft/sec
VOPTK	Optimum velocity for aircraft in knots
VS	Forward speed in ft/sec
VSK	Forward speed in knots
VTIP	Tip velocity of the main rotor system
VTIPTR	Tail rotor tip velocity
VTNEW	Solution to fourth order differential equation
VVERT	Vertical velocity
WE	Manufacturers empty weight
WFC	Cruise fuel flow rate
WFCR	Fuel flow rate for cruise flight
WFM	Military fuel flow rate
WFME	Fuel flow rate for max endurance velocity
WFN	Normal fuel flow rate
WG	Gross weight
WGNEW	New gross weight
WXO	Transmission and oil weight
WXOM	Transmission and oil weight (multiple engine)

W1	Rotor weight
W2A	Tail rotor weight
W2B	Tail rotor structure weight
W3	Body weight
W4	Landing gear weight
W5	Nacelle weight
W6A	Engine weight
W6B	Drive weight
W6C	Fuel tank weight
W7	Flight control weight
W8	Auxillary power weight
W9	Instrument weight
W10	Hydraulic weight
W11	Electrical weight
W12	Avionics weight
W13	Furnishings weight
W14	Air and ice weight
W15	Load and handling weight
XO	Radius used for stall analysis (inboard)
XRLG	Fixed or retractable landing gear
XS	Radius outboard analysis
YMC	Yearly maintenance cost of an engine
YMCM	Yearly maintenance costs (multiple engine)

YOC	Yearly operating cost of an engine
YOCM	Yearly operating costs (multiple engine)
ZCMPLX	Array for library function
ZHI	Zero horsepower intercept

C. PROGRAM LISTING

```
      REAL TRIP1,TRIP2,TRIP3,TRIP4,SC,HOVIGE,RSPEC,FSLTS,MAXRC,SPCLOD,TR
     1IP5,COUNT/0./,IR
      REAL WG,GWSPEC
      REAL WE
      REAL A,MACH,VMAX,PIE,RHOSL
      REAL DL,R,AREAMR
      REAL OMEGA
      REAL VTIP,CT
      REAL VMAXF,MAXV,MU,BL,SIGMA
      REAL CHORD,AR
      REAL CL
      REAL CLA,CDC
      REAL B,PI,PC,PT,PIHP,POHP,PTHP,HP
      REAL FUEL,USELOD,STT,SB,S,W1,W2A,W2B,W3,W4,W5,W6A,W6B,W6C,W7,W8,W9
     1,W10,W11,W12,W13,W14,W15,REVWE,REVWG,TYPE
      REAL M,ANS,CLD/0./
      REAL STEP,FL,LG,XRLG,NW
      REAL H,C,PPCGE,PITLGE,PTHOVS
      REAL LCAC,EFPAFF,KNTS
      REAL VF,PPF,POF,VI,VIT,PITLF,PTF,MACHT,PPFS(55),POFS(55),PITLFS(55
     1),PTFS(55),AALT,RHOALT,PPFA(55),POFA(55),PITLFA(55),PTFA(55),TEMP,
     2THETA,PRESS,SIG,PA,CONST
      REAL RTR,OMEGTR,CDOTR,LTR,ARTR,CHORDT,SIGTR
      REAL AREATR,TTR,VTIPTR,CTTR,BTR,PITLTR,POTR,PTTRH,PTTRHP,CTTA,BTA,
     1PITLTA,POTA,PTTAH,PTTAHP
      REAL MUTR,PCTRF,POTRFS(55),PITRFS(55),PTTRFS(55),MTTR,POTRFA(55),P
     1ITRFA(55),PTTRFA(55),VITR,VITTR,PTTRF,PITLTF
      REAL TTR160,TTR80,VS,BVS,CL80,CL160,VF80,VF160,CLARVS,A80,A160,ARV
     1S
      REAL LAMBDA,KS,MCRIT,MTIP,LERR,MCRO,LAMBD1,CLMAX,VL,VMAXK,PCMPA(55
     1),PCMPS(55),C1,C2,T1,T2,T3,T4,A11,A12,A13,A14,DP,DLAMB,LREF,E1,E2,
     2E3,D1,D2,CYCLIC,COLL,TWIST,GAM,AMAX,BS,RT,XS,XO,CS,CPS,KS,PS,A90,A
     3270,A90D,A270D,MD,CPC,TSHP,VOPT,VOPTK,VSK,THETA0,THETA2,DA270,DREF
     4,DERR,PMBS,CYCD,COLLD
      REAL PTAH,PCX(55),PIX(55),PPX(55),PTX(55),POY(55),PIY(55),PPY(55),
     1PTY(55),KNOTS(55)
      REAL PACJS,PADJA,RRSHP
      REAL RHCS,CTH,BH,PITLH,PPOGEH,POH,PTH,RSHPM,PTACH,PITLGH
      REAL ESHPR
      REAL AFHPY,AFHPF,AASLY,HL,PM(6),OC(6),YMC(6),YOC(6),MTBR(6),NRPL(6
     1),NXRPL(6),EIW(6),RC(6),DW(6),IF(6),IC(6),SV(6),WXO(6),SHPM(6),LAM
     2FR(6),MTBF(6),RELY(6),AVAIL(6),MTBMA(6),MDT(6),LCC(6),RDC(6),MAINT
     3(6),DWM(6),ICM(6),SHPMM(6),RDCM(6),MTBRM(6),YMCM(6),YOCM(6),NRPLM(
     46),NXRPLM(6),EIWM(6),RCM(6),SVM(6),WXOM(6),RELYM(6),AVAILM(6),LCCM
     5(6),MAINTM(6),SHPC(6),SHPN(6),ENGSEL
```

```
      REAL EW,EWNEW,WGNEW,COMPAR
      REAL WFM,WFC,WFN,SFCN(6),SFCM(6),SFCC(6)
      REAL BETA,ALPHA
      REAL DELTA,ZHI
      REAL PSHP,TYPEM,FSLT
      REAL VMAXR
      REAL VMAXE,RSHPME,RSHRME,WFME
      REAL RSHPC,RSHPRC,WFCR,RNGMAX,VCR
      REAL FW,GALIN,GALOUT,EXCESS
      REAL DWC,RNGNMX,NEWUSE,SIM
      REAL VVERT,EFPAVF,PC,VFWD,PPC,POC,PIVERT,VINEW,PAVAIL,PTAVAL,PTVER
     1T,VITNEW(5),VTNEW,RCLIMB
      REAL ALT,PALT,TALT,RHOMH
      REAL ALTSC,RHOSC
      REAL TOTALC,Q,C1,C2A,C2B,C3,C4,C5,C6A,C6B,C6C,C7,C8,C9,C10,C11,C12
     1,C13,C14,C15
      REAL PP,KNT,RBS,FWNEW,VELMAX
      INTEGER I,BLADES,NENG,PEOPLE,BLADTR,IHP(600),CREW,N,NN,NDEG,IER/0/
     1,K
      COMPLEX ZCMFLX(4)
      DATA DW/158.,288.,423.,709.,580.,750./
      DATA SHFM/420.,708.,1561.,1800.,2500.,3400./
      DATA SHPN/370.,659.,1318.,1530.,2200.,3000./
      DATA SHPC/278.,494.,989.,1148.,1650.,2250./
      DATA SFCM/.650,.573,.460,.595,.615,.543/
      DATA SFCN/.651,.573,.470,.606,.622,.562/
      DATA SFCC/.709,.599,.510,.661,.678,.610/
      DATA IC/93.,100.,580.,360.,640.,700./
      DATA OC/.008,.016,.020,.035,.040,.060/
      DATA PM/.025,.050,.100,.125,.160,.220/
      DATA MTBMA/3.5,3.0,2.0,3.0,4.0,3.5/
      DATA MDT/.7,.6,.5,1.3,2.,2.6/
      DATA MTBF/165.,210.,205.,285.,280.,320./
      DATA MTBR/600.,750.,800.,800.,1000.,750./
      DATA RCC/0.,0.,0.,0.,0.,0./
      DATA IF/.29,.29,.27,.24,.27,.24/
      DATA DERR/.001/,LERR/.0001/
C*********************************************************************
      WRITE (6,1560)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 10
      CALL TEK618
      GO TO 20
10    CONTINUE
      TRIP5=5.
20    CONTINUE
      TRIP1=0.
```

```
TRIP2=0.
TRIP3=0.
TRIP4=0.
WRITE (6,2660)
READ (5,*) CREW
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2750)
READ (5,*) SPCLOD
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2680)
READ (5,*) FOVIGE
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2670)
READ (5,*) SC
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,1620)
READ (5,*) VMAXF
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2370)
READ (5,*) VCR
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2360)
READ (5,*) RNGMAX
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2720)
READ (5,*) MAXRC
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,1570)
READ (5,*) GWSPEC
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2690)
READ (5,*) FSPEC
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2700)
READ (5,*) FSLTS
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2050)
READ (5,*) AFHPY
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2060)
READ (5,*) AFHPF
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2070)
READ (5,*) AASLY
CALL FRTCMS ('CLRSCRN 6')
WRITE (6,2640)
READ (5,*) PA
CALL FRTCMS ('CLRSCRN 6')
```

```
      WRITE (6,2650)
      READ (5,*) TEMP
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2820)
      READ (5,*) IR
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C     2.1 MAKE A ROUGH ESTIMATE OF GROSS WEIGHT                        *
C***********************************************************************
      WRITE (6,1590)
      READ (5,*) WG
      CALL FRTCMS ('CLRSCRN 6')
      WG=0.8*WG
      WRITE (6,1600) WG
C***********************************************************************
C     2.2 MAKE A ROUGH ESTIMATE OF THE MANUFACTURER'S EMPTY            *
C         WEIGHT                                                       *
C***********************************************************************
      WRITE (6,1580)
      READ (5,*) WE
      CALL FRTCMS ('CLRSCRN 6')
C***********************************************************************
C     2.3 CALCULATE THE MAXIMUM TIP VELOCITY                           *
C***********************************************************************
      A=1116.89
      MACH=0.65
      VMAX=MACH*A
      PIE=3.1415927
      RHOSL=.0023769
C***********************************************************************
C     2.4 DETERMINE THE ROTOR RADIUS                                   *
C***********************************************************************
      WRITE (6,1610) WG
      READ (5,*) DL
      CALL FRTCMS ('CLRSCRN 6')
30    R=SQRT(WG/(PIE*DL))
      AREAMR=PIE*R**2
C***********************************************************************
C     2.5 DETERMINE A FIRST-CUT ROTATIONAL VELOCITY                    *
C***********************************************************************
      OMEGA=VMAX/R
C***********************************************************************
C     2.6 MAKE A FIRST-CUT DETERMINATION OF THRUST                     *
C         COEFFICIENT                                                  *
C***********************************************************************
40    CONTINUE
      VTIP=OMEGA*R
      CT=WG/(AREAMR*RHOSL*VTIP**2)
```

```
C*****************************************************************
C     2.7 DETERMINE THE BLADE SOLIDITY                           *
C*****************************************************************
      IF (TRIP1.EQ.1.) GO TO 50
      MAXV=VMAXF
      VMAXF=VMAXF*1.151*5280.0/3600.0
50    CONTINUE
      MU=VMAXF/VTIP
      WRITE (6,1630) MU
      WRITE (6,1640)
      READ (5,*) BL
      CALL FRTCMS ('CLRSCRN 6')
      SIGMA=CT/BL
C*****************************************************************
C     2.8 DETERMINE THE NUMBER OF MAIN ROTOR BLADES              *
C*****************************************************************
      IF (TRIP1.EQ.1.) GO TO 60
      WRITE (6,1650)
      READ (5,*) BLADES
      CALL FRTCMS ('CLRSCRN 6')
60    CONTINUE
C*****************************************************************
C     2.9 DETERMINE THE CHORD AND THE ASPECT RATIO               *
C*****************************************************************
      CHORD=SIGMA*PIE*R/FLOAT(BLADES)
70    AR=R/CHORD
      IF (AR.GT.20.) GO TO 80
      IF (AR.LT.15.) GO TO 80
      GO TO 90
80    CONTINUE
      WRITE (6,1660) WG,WE,A,VMAX,DL,R,OMEGA,VTIP,CT,MU,BL,SIGMA,BLADES,
     1CHORD
      WRITE (8,1660) WG,WE,A,VMAX,DL,R,OMEGA,VTIP,CT,MU,BL,SIGMA,BLADES,
     1CHORD
      WRITE (6,1670) AR,OMEGA
      WRITE (8,1670) AR,OMEGA
      WRITE (6,1680)
      READ (5,*) OMEGA
      CALL FRTCMS ('CLRSCRN 6')
      TRIP1=1.
      GO TO 40
90    CONTINUE
C*****************************************************************
C     2.10 DETERMINE THE AVERAGE LIFT COEFFICIENT                *
C*****************************************************************
      CL=(6.*CT)/SIGMA
C*****************************************************************
C     2.11 CHOOSE AN AIRFOIL SECTION FOR THE MAIN ROTOR BLADES   *
```

```
C                                                                        *
C      2.12 DETERMINE AVERAGE LIFT CURVE SLOPE AND AVERAGE PROFILE       *
C           DRAG CCEFFICIENT                                             *
C************************************************************************
       IF (TRIP2.EC.2.) GO TO 100
       WRITE (6,1690)
       READ (5,*) CLA
       CLA=CLA*180./PIE
       CALL FRTCMS ('CLRSCRN 6')
100    CONTINUE
       IF (TRIF2.EC.2.) GO TO 110
       WRITE (6,1700)
       READ (5,*) CDO
       CALL FRTCMS ('CLRSCRN 6')
110    CONTINUE
       WRITE (6,1710) WG,WE,A,VMAX,DL,R,OMEGA,VTIP,CT,MU,BL,SIGMA,BLADES,
      1CHORD,AR,CL,CLA,CDO
       WRITE (8,1710) WG,WE,A,VMAX,DL,R,OMEGA,VTIP,CT,MU,BL,SIGMA,BLADES,
      1CHORD,AR,CL,CLA,CDO
120    CONTINUE
C************************************************************************
C      3.1 MAKE FIFST ESTIMATE OF THE POWER REQUIRED TO HOVER (OPE) SSL *
C************************************************************************
       B=1.-SQRT(2.*CT)/FLOAT(BLADES)
       PI=(1./B)*(WG**1.5/SQRT(2.*RHOSL*AREAMR))
       PO=.125*SIGMA*CDO*RHOSL*AREAMR*VTIP**3
       PT=PI+PC
       PIHP=PI/550.
       POHP=PO/550.
       PTHP=PT/550.
       HP=PT/550.
C************************************************************************
C      3.2 MAKE SECOND GROSS WEIGHT ESTIMATE                             *
C************************************************************************
       IF (TRIF2.EC.2.) GO TO 130
       WRITE (6,1720)
       READ (5,*) FUEL
       CALL FRTCMS ('CLRSCRN 6')
       WRITE (6,1730)
       READ (5,*) USELOD
       CALL FRTCMS ('CLRSCRN 6')
       WRITE (6,1740)
       READ (5,*) FEOPLE
       CALL FRTCMS ('CLRSCRN 6')
       WRITE (6,1750)
       READ (5,*) NENG
       CALL FRTCMS ('CLRSCRN 6')
       WRITE (6,2710)
```

```
      READ (5,*) TYPE
      CALL FRTCMS ('CLRSCRN 6')
130   CONTINUE
      IF (TYPE.NE.1.) GO TO 160
      IF (TRIP2.EQ.2.) GO TO 140
      WG=173.701*WE**.378
140   CONTINUE
      STT=.264*EXP(.0135*HP)
      SB=194.274*ALOG(WG)-1306.779
      S=CHORD*(FLOAT(BLADES))*R
      W1=408.562*ALOG(S)-1142.917
      W2A=2.219*EXP(.0005*WG)
      W2B=19.131*ALOG(STT)-32.414
      W3=.00901*SB**1.917
      IF (COUNT.NE.0.) GO TO 150
      W4=-.0539*WG+200.912
150   CONTINUE
      W5=34.
      W6A=-.0896*HP+221.338*FLOAT(NENG)
      W6B=17.190*EXP(.0008*WG)
      W6C=.384*(FUEL/6.5)**1.0717
      W7=(1.28E-10)*WG**3.469
      W8=0.
      W9=24.571*EXP(.0004*HP)
      W10=0.0
      W11=-51.0661*ALOG(SB)+367.947
      W12=1062.00451-122.282*ALOG(1120.354*EXP(.003*HP))
      W13=19.800*(EXP(.372*FLOAT(PEOPLE))+EXP(-.033*SB))
      W14=-22.371*ALOG(SB)+143.396
      W15=0.0
      GO TO 270
160   IF (TYPE.NE.2.) GO TO 240
      IF (TRIP2.EQ.2.) GO TO 170
      WG=16239.43*ALOG(WE)-130252.76
170   CONTINUE
      STT=.0376*HP-8.106
      SB=636.081*EXP(.000011*WG)
      S=CHORD*(FLOAT(BLADES))*R
      W1=11.0702*S-168.888
      W2A=.00438*WG+12.470
      W2B=2.411*STT-19.531
      W3=.282*SB**1.272
      IF (COUNT.NE.0.) GO TO 190
      IF (WG.GT.6000.) GO TO 180
      W4=.025*EXP(.000062*WG+8.020)
      GO TO 190
180   W4=301.577*ALOG(WG)-2319.890
190   CONTINUE
```

```
      W5=.02*EXP(.000062*WG+8.02)
      IF (NENG.NE.1.) GO TO 200
      W6A=130.0+.451*HP
      GO TO 210
200   W6A=(295.0+.188*HP)*FLOAT(NENG)
210   W6B=(741.460*ALOG(HP)-4542.0420)
      W6C=(363.24*ALOG(FUEL/6.5)-1656.521)
      W7=210.858*EXP(.000059*WG)
      IF (NENG.NE.1.) GO TO 220
      W8=0.0
      GO TO 230
220   W8=190.0
230   W9=56.0975*ALOG(HP)-312.237
      W10=.00362*WG+11.553
      W11=481.735*ALOG(SB)-2794.53
      W12=.139*HP+77.823
      W13=.175*SB+22.*FLOAT(PEOPLE)-10.
      W14=122.468*ALOG(SB)-730.252
      W15=84.5
      GO TO 270
240   CONTINUE
      IF (TRIP2.EQ.2.) GO TO 250
      WG=4.979*WE**.887
250   CONTINUE
      STT=60.127*EXP(.000145*HP)
      SB=426.378*EXP(.000045*WG)
      S=CHORD*(FLOAT(BLADES))*R
      W1=707.174*EXP(.00539*S)
      W2A=324.550*ALOG(WG)-3021.510
      W2B=-18.+2.83*STT
      W3=2.9818*SB-1321.921
      IF (COUNT.NE.0.) GO TO 260
      W4=258.358*EXP(.000041*WG)
260   CONTINUE
      W5=.014*(.2041*WG)**1.136
      W6A=(348.+.910*HP)*FLOAT(NENG)
      W6B=(.999*HP**.959)
      W6C=(454.619*(FUEL/6.5)**(-.0566))
      W7=.00334*WG**1.224
      W8=139.0
      W9=68.266*ALOG(HP)-387.598
      W10=(6.63E-7)*WG**1.863
      W11=9.780*SB**.539
      W12=(16744.967*ALOG(HP)-108666.)**.536*1.90
      W13=.159*SB+18.11*FLOAT(PEOPLE)
      W14=117.771*ALOG(SB)-710.594
      W15=-72.+.111*SB+3.49*FLOAT(PEOPLE)
270   CONTINUE
```

```
      REVWE=W1+W2A+W2B+W3+W4+W5+W6A+W6B+W6C+W7+W8+W9+W10+W11+W12+W13+W14
     1+W15
      REVWG=REVWE+FUEL+USELOD
      WRITE (6,1760) B,PIHP,POHP,PTHP,WE,FUEL,PEOPLE,USELOD,NENG,WG,SIGM
     1A,R,HP,W1,W2A,W2B,W3,W4
      WRITE (6,1770) W5,W6A,W6B,W6C,W7,W8,W9,W10,W11,W12,W13,W14,W15,REV
     1WE,REVWG
      WRITE (8,1760) B,PIHP,POHP,PTHP,WE,FUEL,PEOPLE,USELOD,NENG,WG,SIGM
     1A,R,HP,W1,W2A,W2B,W3,W4
      WRITE (8,1770) W5,W6A,W6B,W6C,W7,W8,W9,W10,W11,W12,W13,W14,W15,REV
     1WE,REVWG
C*********************************************************************
C     3.3 VALIDATE DISC LOADING                                      *
C*********************************************************************
      WRITE (6,1800) WG
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 280
      WRITE (6,1810)
      READ (5,*) CL
      CALL FRTCMS ('CLRSCRN 6')
      WG=REVWG
      WE=REVWE
      TRIP1=1.
      TRIP2=2.
      GO TO 30
280   CONTINUE
C*********************************************************************
C     3.4 ESTABLISH FIGURE OF MERIT AT APPROXIMATELY 0.75            *
C*********************************************************************
      M=(PI/PT)*100.
      WRITE (6,1780) M
      WRITE (8,1780) M
290   CONTINUE
      WRITE (6,1790)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 300
      TRIP1=1.
      TRIP2=2.
      WG=REVWG
      WE=REVWE
      OLD=REVWG
      GO TO 30
300   IF (ANS.NE.2.) GO TO 310
      WRITE (6,2270) CHORD
      WRITE (6,1870)
      READ (5,*) CHORD
```

```
      CALL FRTCMS ('CLRSCRN 6')
      WG=REVWG
      WE=REVWE
      OLD=REVWG
      SIGMA=(FLOAT(BLADES)*CHORD)/(PIE*R)
      TRIP1=1.
      TRIP2=2.
      GO TO 70
310   IF (ANS.NE.3.) GO TO 320
      WRITE (6,1680)
      READ (5,*) OMEGA
      CALL FRTCMS ('CLRSCRN 6')
      TRIP1=1.
      TRIP2=2.
      WE=REVWE
      WG=REVWG
      OLD=REVWG
      GO TO 40
320   CONTINUE
C*********************************************************************
C     3.5 REFINE GROSS WEIGHT ESTIMATE                                *
C*********************************************************************
      IF (COUNT.GE.2.) GO TO 360
      COUNT=COUNT+1.
      IF (COUNT.GT.1.) GO TO 330
      WRITE (6,2780)
      READ (5,*) LG
      CALL FRTCMS ('CLRSCRN 6')
330   CONTINUE
      IF (BLADES.GT.2) FL=4.
      IF (BLADES.LT.3) FL=2.
      IF (LG.NE.1.) GO TO 350
      IF (COUNT.GT.1.) GO TO 340
      WRITE (6,2790)
      READ (5,*) XRLG
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2800)
      READ (5,*) NW
      CALL FRTCMS ('CLRSCRN 6')
340   CONTINUE
      W4=.4013*(WG**.6662)*(NW**.536)*(XRLG**.1198)
      WG=REVWG
      WE=REVWE
      OLD=REVWG
      GO TO 120
350   CONTINUE
      W4=.0245*(WG**.8606)*(FL**.8046)
      WG=REVWG
```

```
      WE=REVWE
      OLD=REVWG
      GO TO 120
C***********************************************************************
C     3.6 MAKE THIRD ESTIMATE OF POWER REQUIRED TC HOVER              *
C                                                                     *
C     3.7 REPEAT THE GROSS WEIGHT ESTIMATE AND THE HOVER              *
C         POWER ITERATIONS                                            *
C***********************************************************************
360   CONTINUE
      STEP=1.-(OLC/REVWG)
      IF (STEP.LT.0.1) GO TO 370
      WRITE (6,2740)
      GO TO 290
370   IF (STEP.GT.-.1) GO TO 380
      WRITE (6,2740)
      GO TO 290
380   CONTINUE
      WG=REVWG
      IF (TRIF3.EC.3.) GO TO 390
C***********************************************************************
C     3.8 DETERMINE THE POWER REQUIRED TO HOVER IGE, SSL              *
C***********************************************************************
      WRITE (6,1820)
      READ (5,*) H
      CALL FRTCMS ('CLRSCRN 6')
      H=H+10.
390   CONTINUE
      D=2.*R
      PPOGE=-.1276*(H/D)**4+.7080*(H/D)**3-1.4569*(H/D)**2+1.3432*(H/D)+
     1.5147
      PITLGE=PPOGE*PI
      PTHOVS=PITLGE+PO
C***********************************************************************
C     3.9 DETERMINE EQUIVALENT FLAT PLATE AREA (HCRIZONTAL)           *
C***********************************************************************
      WRITE (6,1600) WG
      WRITE (6,1830)
      READ (5,*) LOAD
      CALL FRTCMS ('CLRSCRN 6')
      EFPAFF=WG/LCAD
      KNTS=0.0
      WRITE (6,1840)
      WRITE (8,1840)
C***********************************************************************
C     3.10 DETERMINE TOTAL POWER REQUIRED AND TIP MACH                *
C          NUMBER                                                     *
C***********************************************************************
```

```
      NN=AINT(MAXV/5.)+1
      N=AINT(MAXV/5.)+11
      DO 400 I=1,N
      VF=KNTS*1.151*5280./3600.
      PPF=.5*RHOSL*(VF**3)*EFPAFF
      PPF=PPF/550.
      MU=VF/VTIP
      POF=(1.+4.3*MU**2)*PO
      POF=POF/550.
      VI=SQRT(WG/(2.*RHOSL*AREAMR))
      VIT=VI*SQRT((-(VF**2/(2.*VI**2)))
     1             +SQRT(((VF**2/(2.*VI**2))**2)+1.))
      PITLF=(1./B)*WG*VIT
      PITLF=PITLF/550.
      PTF=PITLF+PCF+PPF
      MACHT=(VF+VTIP)/A
      PPFS(I)=PPF
      POFS(I)=POF
      PITLFS(I)=PITLF
      PTFS(I)=PTF
      WRITE (6,1850) KNTS,MACHT,PITLF,POF,PPF,PTF
      WRITE (8,1850) KNTS,MACHT,PITLF,POF,PPF,PTF
      KNTS=KNTS+5.
400   CONTINUE
      TEMP=TEMP+460.
      THETA=TEMP/518.688
      CONST=6.87535E-6
      PRESS=2116.22*(1.-CONST*PA)**5.2561
      SIG=PRESS/2116.22
      RHOALT=.0023769*SIG*THETA
      AALT=SQRT(1.4*32.174*53.3*TEMP)
      WRITE (6,1860)
      WRITE (8,1860)
      KNTS=0.0
      DO 410 I=1,N
      VF=KNTS*1.151*5280./3600.
      PPF=.5*RHOALT*(VF**3)*EFPAFF
      PPF=PPF/550.
      MU=VF/VTIP
      PO=.125*SIGMA*CDO*RHOALT*AREAMR*VTIP**3
      POF=(1.+4.3*MU**2)*PO
      POF=POF/550.
      VI=SQRT(WG/(2.*RHOALT*AREAMR))
      VIT=VI*SQRT((-(VF**2/(2.*VI**2)))
     1             +SQRT(((VF**2/(2.*VI**2))**2)+1.))
      PITLF=(1./B)*WG*VIT
      PITLF=PITLF/550.
      PTF=PITLF+PCF+PPF
```

```
      MACHT=(VF+VTIP)/AALT
      PPFA(I)=PPF
      POFA(I)=POF
      PITLFA(I)=PITLF
      PTFA(I)=PTF
      WRITE (6,1850) KNTS,MACHT,PITLF,POF,PPF,PTF
      WRITE (8,1850) KNTS,MACHT,PITLF,POF,PPF,PTF
      KNTS=KNTS+5.
410   CONTINUE
C**********************************************************************
C     4.1 MAKE PRELIMINARY SIZING OF TAIL ROTOR                        *
C**********************************************************************
      RTR=1.3*SQRT(WG/1000.)
      WRITE (6,1880) RTR
      WRITE (8,1880) RTR
      OMEGTR=4.5*OMEGA
      WRITE (6,1890) OMEGTR
      WRITE (8,1890) OMEGTR
      CDOTR=1.38*CDO
      WRITE (6,1900) CDOTR
      WRITE (8,1900) CDOTR
      IF (TRIP3.EQ.3.) GO TO 420
      WRITE (6,1910)
      READ (5,*) BLADTR
      CALL FRTCMS ('CLRSCRN 6')
420   CONTINUE
      LTR=R+RTR+.5
      IF (TRIP3.EQ.3.) GO TO 430
      WRITE (6,1920)
      READ (5,*) ARTR
      CALL FRTCMS ('CLRSCRN 6')
430   CONTINUE
      CHORDT=RTR/ARTR
      SIGTR=(FLOAT(BLADTR)*CHORDT)/(PIE*RTR)
C**********************************************************************
C     4.2 DETERMINE TAIL ROTOR POWER REQUIRED AT HOVER                 *
C**********************************************************************
      AREATR=PIE*RTR**2
      TTR=PT/(OMEGA*LTR)
      VTIPTR=OMEGTR*RTR
      CTTR=TTR/(AREATR*RHOSL*VTIPTR**2)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      PITLTR=(1./BTR)*(TTR**1.5/SQRT(2.*RHOSL*AREATR))
      POTR=.125*SIGTR*CDOTR*RHOSL*AREATR*(VTIPTR**3)
      PTTRH=PITLTR+POTR
      PTTRHP=PTTRH/550.
      CTTA=TTR/(AREATR*RHOALT*VTIPTR**2)
      BTA=1.-SQRT(2.*CTTA)/FLOAT(BLADTR)
```

```
      PITLTA=(1./BTA)*(TTR**1.5/SQRT(2.*RHOALT*AREATR))
      POTA=.125*SIGTR*CDOTR*RHOALT*AREATR*(VTIPTR**3)
      PTTAH=PITLTR+POTR
      PTTAHP=PTTRH/550.
C**************************************************************************
C     4.3 DETERMINE TAIL ROTOR POWER REQUIRED FOR FORWARD                *
C         FLIGHT                                                          *
C                                                                         *
C     4.5 DETERMINE MAXIMUM TIP MACH NUMBER FOR FORWARD                   *
C         FLIGHT                                                          *
C**************************************************************************
      KNTS=0.0
      WRITE (6,1930)
      WRITE (8,1930)
      DO 440 I=1,N
      VF=KNTS*1.151*5280./3600.
      MUTR=VF/VTIPTR
      POTRF=(1.+4.3*MUTR**2)*POTR
      POTRF=POTRF/550.
      PTF=PTFS(I)
      TTR=((PTF*550.)/(OMEGA*LTR))
      CTTR=TTR/(AREATR*RHOSL*(VTIPTR**2))
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      VITR=SQRT(TTR/(2.*RHOSL*AREATR))
      VITTR=VITR*SQRT((-(VF**2/(2.*VITR**2)))
     1+SQRT(((VF**2/(2.*VITR**2))**2)+1.))
      PITLTF=(1./BTR)*TTR*VITTR
      PITLTF=PITLTF/550.
      PTTRF=PITLTF+POTRF
      POTRFS(I)=POTRF
      PITRFS(I)=PITLTF
      PTTRFS(I)=PTTRF
      MTTR=(VF+VTIPTR)/A
      WRITE (6,1950) KNTS,MTTR,PITLTF,POTRF,PTTRF
      WRITE (8,1950) KNTS,MTTR,PITLTF,POTRF,PTTRF
      KNTS=KNTS+5.
440   CONTINUE
      WRITE (6,1940)
      WRITE (8,1940)
      KNTS=0.0
      DO 450 I=1,N
      VF=KNTS*1.151*5280./3600.
      MUTR=VF/VTIPTR
      POTR=.125*SIGTR*CDOTR*RHOALT*AREATR*VTIPTR**3
      POTRF=(1.+4.3*MUTR**2)*POTR
      POTRF=POTRF/550.
      PTF=PTFA(I)
      TTR=((PTF*550.)/(OMEGA*LTR))
```

```
      CTTR=TTR/(AREATR*(VTIPTR**2)*RHOALT)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      VITR=SQRT(TTR/(2.*RHOALT*AREATR))
      VITTR=VITR*SQRT((-(VF**2/(2.*VITR**2)))
     1+SQRT(((VF**2/(2.*VITR**2))**2)+1.))
      PITLTF=(1./ETR)*TTR*VITTR
      PITLTF=PITLTF/550.
      PTTRF=PITLTF+POTRF
      POTRFA(I)=PCTRF
      PITRFA(I)=PITLTF
      PTTRFA(I)=PTTRF
      MTTR=(VF+VTIPTR)/AALT
      WRITE (6,1950) KNTS,MTTR,PITLTF,POTRF,PTTRF
      WRITE (8,1950) KNTS,MTTR,PITLTF,POTRF,PTTRF
      KNTS=KNTS+5.
450   CONTINUE
C**********************************************************************
C     4.4 VERTICAL STABILIZER                                         *
C**********************************************************************
      IF (TRIP3.EQ.3.) GO TO 460
      WRITE (6,2960)
      READ (5,*) EVS
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2970) SIGTR
      READ (5,*) VS
      CALL FRTCMS ('CLRSCRN 6')
460   CONTINUE
      VF80=80.*1.151*5280./3600.
      VF160=160.*1.151*5280./3600.
      ARVS=BVS**2/VS
      TTR80=(PTFS(17)*550.)/(LTR*OMEGA)
      TTR160=(PTFS(34)*550.)/(LTR*OMEGA)
      CL80=(2.*TTR80)/(RHOSL*VF80**2*VS)
      CL160=(2.*TTR160)/(RHOSL*VF160**2*VS)
      CLARVS=((2.*PIE)/(2.+SQRT(ARVS**2*2.+4.)))*ARVS*PIE/180.
      A80=((CL80-.4)/CLARVS)
      A160=((CL160-.4)/CLARVS)
      WRITE (6,2980) CL80,CL160,A80,A160
      WRITE (8,2980) CL80,CL160,A80,A160
C**********************************************************************
C     5.1 DETERMINE RETREATING BLADE STALL EFFECTS                    *
C                                                                     *
C     5.2 DETERMINE STALL POWER INCREMENT                             *
C                                                                     *
C     5.3 DETERMINE COMPRESSIBILITY EFFECTS                           *
C**********************************************************************
      KNT=0.
      TWIST=-10.*PIE/180.
```

```
      IF (TRIP3.EQ.3.) GO TO 470
      WRITE (6,2930)
      READ (5,*) MCRO
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2940)
      READ (5,*) CLMAX
      CALL FRTCMS ('CLRSCRN 6')
470   CONTINUE
      AMAX=CLMAX/CLA
      WRITE (8,2920) R,CHORD,BLADES,WG,VTIP,EFPAFF,NENG,H,RHOALT,AALT,TW
     1IST,CLMAX,AMAX,CLA,CDO,MCRO
      CT=WG/(AREAMR*RHOALT*(VTIP**2))
      IF (H/D.GT.1.55) PPOGE=1.0
      B=1.0-(SQRT(2.*CT)/FLOAT(BLADES))
      WRITE (8,2910) CT,AREAMR,SIGMA,B,PPOGE
      VMAX=SQRT(WG/2./RHOALT/AREAMR)*(4./(EFPAFF/AREAMR))**.333334
      VMAXK=VMAX/1.68894
      VELMAX=VMAXK
      DO 630 I=1,N
      WRITE (8,2880) KNT
      VF=KNT*1.151*5280./3600.
      MU=VF/VTIP
      VL=VF**2/(2.*VI**2)
      C1=(B**2+.5*MU**2)
      C2=(B**2-.5*MU**2)
      T1=.5*C1
      T2=(B**3)/3.+(MU**2*B*.5)
      T3=(B**2/4.)*(B**2+MU**2)
      T4=(MU/2.)*(B**2+MU**2/4.)
      A11=((B**2*MU*.5-(MU**3/8.))*4.)/(B**2*C2)
      A12=(8.*MU*B)/(3.*C2)
      A13=(2.*MU*B**2)/C2
      A14=(B**2+1.5*MU**2)/C2
      IF (VF.GT.0.) GO TO 480
      ALPHA=0.
      WRITE (8,2900) ALPHA
480   LAMBD1=-SQRT(CT/2.)
      IF (MU.LE.0.1) GO TO 510
      IF (VF.EQ.0.) DP=0.
      IF (VF.EQ.0.) GO TO 490
      DP=PPFA(I)*550/VF
      ALPHA=-DP/WG
490   CONTINUE
500   LAMBDA=-CT/SQRT(2*(LAMBD1**2)+MU**2)+MU*TAN(ALPHA)
      DLAMB=LAMBDA-LAMBD1
      LAMBD1=LAMBDA
      LREF=ABS(DLAMB)
      IF (LREF.GE.LERR) GO TO 500
```

```
510   LAMBDA=LAMBD1
      E1=(2.*CT)/(SIGMA*CLA)
      E2=T1*LAMBDA
      E3=T3*TWIST
      D1=((2.*CT)/(SIGMA*CLA))-T1*LAMBDA-TWIST*T3
      D2=-(A11*LAMBDA)-(TWIST*A13)
      CYCLIC=((D2*T2)-(D1*A12))/(T2*A14-T4*A12)
      COLL=(D1-T4*CYCLIC)/T2
      CYCD=CYCLIC*57.29578
      COLLD=CCLL*57.29578
      THETA0=CCLL*57.29578
      THETA2=CYCLIC*57.29578
      WRITE (8,2830) A11,A12,A13,A14,T1,T2,T3,T4,LAMBDA
      GAM=AMAX-COLL+CYCLIC
      CS=MU*GAM+LAMBDA
      BS=-MU*TWIST-GAM
      RT=(BS**2-4.*TWIST*CS)
      WRITE (8,2860) RT
      IF (RT) 560,520,520
520   XS=(-BS+SQRT(RT))/(2.*TWIST)
      XO=-XS-BS/TWIST
      IF (XS-1.) 530,560,560
530   IF (XS) 560,560,540
540   CPS=(SIGMA/(24.*PIE))*((1.-MU)**2)*(1.-XS)*SQRT(1.-XS**2)
      IF ((XS+XO)/2..GE.1.0) KS=1.0
      IF ((XS+XO)/2..GT.1.0) GO TO 550
      KS=-(BS/(2.*TWIST)+XS)/(1.-XS)
550   CPS=KS*CPS
      GO TO 570
560   CPS=0.0
      KS=0.0
570   PS=CPS*RHOALT*AREAMR*(VTIP**3)/550.
      WRITE (8,2840) KS,CPS
      A90=COLL+CYCLIC+TWIST+LAMBDA/(1.+MU)
      A270=CCLL-CYCLIC+TWIST+LAMBDA/(1.+MU)
      A90D=A90*57.29278
      A270D=A270*57.29278
      WRITE (8,2850) CYCD,COLLD,A90D,A270D
      MTIP=(VF+VTIP)/AALT
      MCRIT=MCRO-CLA*A90*.113
      IF (MTIP-1.) 590,580,580
580   WRITE (8,2890)
      GO TO 610
590   MD=MTIP-MCRIT-0.06
      IF (MD) 610,610,600
600   CPC=SIGMA*(C.012*MD+.1*(MD**3))
      GO TO 620
610   CPC=0.0
```

```
      MD=0.0
620   PMBS=CPC*RHCALT*AREAMR*(VTIP**3)/550.
      PCMPA(I)=PMES+PS
      WRITE (8,2870) MTIP,MCRIT,MD,CPC,PITLFA(I),POFA(I),PPFA(I),PMBS,PS
     1,PCMPA(I)
      TSHP=1.13*PCMPA(I)+10.0
      VOPT=SQRT(WG/RHOALT/AREAMR*SQRT(AREAMR/3./EFPAFF))
      VOPTK=VCPT/1.68894
      KNT=KNT+5.
630   CONTINUE
      KNT=0.
      K=MAXV+40
      WRITE (6,2430)
      WRITE (8,2430)
      DO 690 I=1,K
      VF=KNT*1.151*5280./3600.
      MU=VF/VTIP
      PP=(.5*RHOALT*EFPAFF*(VF**3))/550.
      C1=(B**2+.5*MU**2)
      C2=(B**2-.5*MU**2)
      T1=.5*C1
      T2=(B**3)/3.+(MU**2*B*.5)
      T3=(B**2/4.)*(B**2+MU**2)
      T4=(MU/2.)*(B**2+MU**2/4.)
      A11=((B**2*MU*.5-(MU**3/8.))*4.)/(B**2*C2)
      A12=(8.*MU*B)/(3.*C2)
      A13=(2.*MU*B**2)/C2
      A14=(B**2+1.5*MU**2)/C2
      IF (VF.GT.0.) GO TO 640
      ALPHA=0.
      GO TO 650
640   ALPHA=-(PP*550.)/VF/WG
650   LAMBD1=-SQRT(CT/2.)
      IF (MU.LE.0.1) GO TO 670
660   LAMBDA=-CT/SQRT(2*(LAMBD1**2)+MU**2)+MU*TAN(ALPHA)
      DLAMB=LAMBDA-LAMBD1
      LAMBD1=LAMBCA
      LREF=ABS(DLAMB)
      IF (LREF.GE.LERR) GO TO 660
670   IF (MU.LE.0.1) LAMBDA=LAMBD1
      E1=(2.*CT)/(SIGMA*CLA)
      E2=T1*LAMBDA
      E3=T3*TWIST
      D1=((2.*CT)/(SIGMA*CLA))-T1*LAMBDA-TWIST*T3
      D2=-(A11*LAMBDA)-(TWIST*A13)
      CYCLIC=((D2*T2)-(D1*A12))/(T2*A14-T4*A12)
      COLL=(D1-T4*CYCLIC)/T2
      THETAO=CCLL*57.29578
```

```
      THETA2=CYCLIC*57.29578
      A270=CCLL-CYCLIC+TWIST+LAMBDA/(1.+MU)
      A270D=A270*57.29278
      DA270=A270-AMAX
      DREF=ABS(DA270)
      IF (A270D.LT.12.) GO TO 680
      IF (A270C.GT.13.) GO TO 680
      VSK=VF/1.68894
      WRITE (6,2440) VSK,A270D
      WRITE (8,2440) VSK,A270D
680   CONTINUE
      KNT=KNT+1.
690   CONTINUE
      KNT=0.
      CT=WG/(AREAMR*RHOSL*(VTIP**2))
      IF (H/D.GT.1.55) PPOGE=1.0
      B=1.0-(SQRT(2.*CT)/FLOAT(BLADES))
      VMAX=SQRT(WG/2./RHOSL/AREAMR)*(4./(EFPAFF/AREAMR))**.333334
      VMAXK=VMAX/1.68894
      DO 850 I=1,N
      VF=KNT*1.151*5280./3600.
      MU=VF/VTIP
      VL=VF**2/(2.*VI**2)
      C1=(B**2+.5*MU**2)
      C2=(B**2-.5*MU**2)
      T1=.5*C1
      T2=(B**3)/3.+(MU**2*B*.5)
      T3=(B**2/4.)*(B**2+MU**2)
      T4=(MU/2.)*(B**2+MU**2/4.)
      A11=((B**2*MU*.5-(MU**3/8.))*4.)/(B**2*C2)
      A12=(8.*MU*B)/(3.*C2)
      A13=(2.*MU*B**2)/C2
      A14=(B**2+1.5*MU**2)/C2
      IF (VF.GT.0.) GO TO 700
      ALPHA=0.
700   LAMBD1=-SQRT(CT/2.)
      IF (MU.LE.0.1) GO TO 730
      IF (VF.EQ.0.) DP=0.
      IF (VF.EQ.0.) GO TO 710
      DP=PPFS(I)*550/VF
      ALPHA=-DP/WG
710   CONTINUE
720   LAMBDA=-CT/SQRT(2*(LAMBD1**2)+MU**2)+MU*TAN(ALPHA)
      DLAMB=LAMBDA-LAMBD1
      LAMBD1=LAMBDA
      LREF=ABS(DLAMB)
      IF (LREF.GE.LERR) GO TO 720
730   LAMBDA=LAMBD1
```

```
      E1=(2.*CT)/(SIGMA*CLA)
      E2=T1*LAMBDA
      E3=T3*TWIST
      D1=((2.*CT)/(SIGMA*CLA))-T1*LAMBDA-TWIST*T3
      D2=-(A11*LAMBDA)-(TWIST*A13)
      CYCLIC=((D2*T2)-(D1*A12))/(T2*A14-T4*A12)
      COLL=(D1-T4*CYCLIC)/T2
      THETA0=COLL*57.29578
      THETA2=CYCLIC*57.29578
      GAM=AMAX-COLL+CYCLIC
      CS=MU*GAM+LAMBDA
      BS=-MU*TWIST-GAM
      RT=(BS**2-4.*TWIST*CS)
      IF (RT) 780,740,740
740   XS=(-BS+SQRT(RT))/(2.*TWIST)
      XO=-XS-BS/TWIST
      IF (XS-1.) 750,780,780
750   IF (XS) 780,780,760
760   CPS=(SIGMA/(24.*PIE))*((1.-MU)**2)*(1.-XS)*SQRT(1.-XS**2)
      IF ((XS+XO)/2..GE.1.0) KS=1.0
      IF ((XS+XO)/2..GT.1.0) GO TO 770
      KS=-(BS/(2.*TWIST)+XS)/(1.-XS)
770   CPS=KS*CPS
      GO TO 790
780   CPS=0.C
      KS=0.0
790   PS=CPS*RHOSL*AREAMR*(VTIP**3)/550.
      A90=COLL+CYCLIC+TWIST+LAMBDA/(1.+MU)
      A270=COLL-CYCLIC+TWIST+LAMBDA/(1.+MU)
      A90D=A9C*57.29278
      A270D=A270*57.29278
      MTIP=(VF+VTIP)/AALT
      MCRIT=MCRO-CLA*A90*.113
      IF (MTIP-1.) 810,800,800
800   CONTINUE
      GO TO 830
810   MD=MTIF-MCRIT-0.06
      IF (MD) 830,830,820
820   CPC=SIGMA*(C.012*MD+.1*(MD**3))
      GO TO 840
830   CPC=0.0
      MD=0.0
840   PMBS=CPC*RHCSL*AREAMR*(VTIP**3)/550.
      PCMPS(I)=PMBS+PS
      TSHP=1.13*PCMPS(I)+10.0
      VOPT=SQRT(WG/RHCSL/AREAMR*SQRT(AREAMR/3./EFPAFF))
      VOPTK=VOPT/1.68894
      KNT=KNT+5.
```

```
850     CONTINUE
        KNT=0.
        DO 900 I=1,K
        VF=KNT*1.151*5280./3600.
        MU=VF/VTIP
        PP=(.5*RHOSL*EFPAFF*(VF**3))/550.
        C1=(B**2+.5*MU**2)
        C2=(B**2-.5*MU**2)
        T1=.5*C1
        T2=(B**3)/3.+(MU**2*B*.5)
        T3=(B**2/4.)*(B**2+MU**2)
        T4=(MU/2.)*(B**2+MU**2/4.)
        A11=((B**2*MU*.5-(MU**3/8.))*4.)/(B**2*C2)
        A12=(8.*MU*B)/(3.*C2)
        A13=(2.*MU*B**2)/C2
        A14=(B**2+1.5*MU**2)/C2
        IF (VF.GT.0.) GO TO 860
        ALPHA=0.
        GO TO 870
860     ALPHA=-(PP*550.)/VF/WG
870     LAMBD1=-SQRT(CT/2.)
        IF (MU.LE.0.1) GO TO 890
880     LAMBDA=-CT/SQRT(2*(LAMBD1**2)+MU**2)+MU*TAN(ALPHA)
        DLAMB=LAMBDA-LAMBD1
        LAMBD1=LAMBDA
        LREF=ABS(DLAMB)
        IF (LREF.GE.LERR) GO TO 880
890     IF (MU.LE.0.1) LAMBDA=LAMBD1
        E1=(2.*CT)/(SIGMA*CLA)
        E2=T1*LAMBDA
        E3=T3*TWIST
        D1=((2.*CT)/(SIGMA*CLA))-T1*LAMBDA-TWIST*T3
        D2=-(A11*LAMBDA)-(TWIST*A13)
        CYCLIC=((D2*T2)-(D1*A12))/(T2*A14-T4*A12)
        COLL=(D1-T4*CYCLIC)/T2
        THETA0=COLL*57.29578
        THETA2=CYCLIC*57.29578
        A270=COLL-CYCLIC+TWIST+LAMBDA/(1.+MU)
        A270D=A270*57.29278
        DA270=A270-AMAX
        DREF=ABS(DA270)
        KNT=KNT+1.
900     CONTINUE
        WRITE (6,2950)
        READ (5,*) FBS
        CALL FRTCMS ('CLRSCRN 6')
C************************************************************************
C       5.4 DETERMINE TOTAL POWER REQUIRED                              *
```

```
C*****************************************************************************
      PTAH=PT+PTTFH
      PTAH=PTAH/550.
      WRITE (6,1960) PTAH
      WRITE (8,1960) PTAH
      KNOTS(1)=0.
      WRITE (6,1970)
      WRITE (8,1970)
      DO 910 I=1,N
      POX(I)=POFS(I)+POTRFS(I)
      PIX(I)=PITLFS(I)+PITRFS(I)
      PPX(I)=PPFS(I)
      PTX(I)=POX(I)+PIX(I)+PPX(I)+PCMPS(I)
      WRITE (6,1980) KNOTS(I),PIX(I),POX(I),PPX(I),PCMPS(I),PTX(I)
      WRITE (8,1980) KNOTS(I),PIX(I),POX(I),PPX(I),PCMPS(I),PTX(I)
      KNOTS(I+1)=KNOTS(I)+5.
910   CONTINUE
      WRITE (6,1990)
      WRITE (8,1990)
      KNOTS(1)=0.
      DO 920 I=1,N
      POY(I)=POFA(I)+POTRFA(I)
      PIY(I)=PITLFA(I)+PITRFA(I)
      PPY(I)=PPFA(I)
      PTY(I)=POY(I)+PIY(I)+PPY(I)+PCMPA(I)
      WRITE (6,1980) KNOTS(I),PIY(I),POY(I),PPY(I),PCMPA(I),PTY(I)
      WRITE (8,1980) KNOTS(I),PIY(I),POY(I),PPY(I),PCMPA(I),PTY(I)
      KNOTS(I+1)=KNOTS(I)+5.
920   CONTINUE
C*****************************************************************************
C     5.5 DETERMINE THE RSHP REQUIRED AT MAXIMUM VELOCITY                   *
C*****************************************************************************
      PADJS=PTX(NN)+PCMPS(NN)
      PADJA=PTY(NN)+PCMPA(NN)
      IF (PADJS.GT.PADJA) GO TO 930
      RRSHP=PADJA
      GO TO 940
930   RRSHP=PADJS
940   CONTINUE
      WRITE (6,2000) RRSHP
      WRITE (8,2000) RRSHP
C*****************************************************************************
C     5.6 DETERMINE RSHP FOR HOVER CEILING, IGE                             *
C*****************************************************************************
      RHOS=.0023769*(1.-CONST*HOVIGE)**4.2561
      CTH=WG/(AREAMR*RHOS*VTIP**2)
      BH=1.-SQRT(2.*CTH)/FLOAT(BLADES)
      PITLH=(1./BH)*(WG**1.5/SQRT(2.*RHOS*AREAMR))
```

```
      PPOGEH=-.1276*(H/D)**4+.708*(H/D)**3-1.4569*(H/D)**2+1.3432*(H/D)+
     1.5147
      PITLGH=PPOGEH*PITLH
      POH=.125*SIGMA*CDO*RHOS*AREAMR*VTIP**3
      PTH=PITLGH+POH
      TTR=PTH/(OMEGA*LTR)
      VTIPTR=OMEGTR*RTR
      CTTR=TTR/(AREATR*RHOS*VTIPTR**2)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      PITLTR=(1./BTR)*(TTR**1.5/SQRT(2.*RHOS*AREATR))
      POTR=.125*SIGTR*CDOTR*RHOS*AREATR*(VTIPTR**3)
      PTTRH=PITLTR+POTR
      PTACH=PTH+PTTRH
      PTACH=PTACH/550.
C***********************************************************************
C     5.7 DETERMINE THE MAXIMUM RSHP REQUIRED                          *
C***********************************************************************
      IF (PTACH.GT.RRSHP) GO TO 950
      RSHPM=RRSHP
      GO TO 960
950   RSHPM=PTACH
960   CONTINUE
C***********************************************************************
C     5.8 DETERMINE THE TOTAL ESHP REQUIRED                            *
C***********************************************************************
      ESHPR=(.1*RSHPM*FLOAT(NENG-1))+1.03*RSHPM+10.
      WRITE (6,2010) NENG,ESHPR
      WRITE (8,2010) NENG,ESHPR
C***********************************************************************
C     6.1 SELECT TYPE AND NUMBER OF ENGINES                            *
C                                                                      *
C     6.2 INSTALLATION WEIGHT                                          *
C***********************************************************************
      WRITE (6,2020) NENG
      WRITE (6,2030)
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 970
      WRITE (6,2040)
      READ (5,*) NENG
      CALL FRTCMS ('CLRSCRN 6')
      GO TO 960
970   CONTINUE
      HL=(AASLY*AFHPY)
      PM(1)=.025
      WRITE (6,2080)
      WRITE (8,2080)
      DO 1100 I=1,6
```

```
      YMC(I)=AFHPY*PM(I)
      YOC(I)=AFHPY*OC(I)
      NRPL(I)=((HL/MTBR(I))-1.)
      NXRPL(I)=AINT(((HL)/MTBR(I))-1.)
      IF (NRPL(I).NE.1.0) GO TO 980
      GO TO 1090
980   IF (NRPL(I).NE.2.) GO TO 990
      GO TO 1090
990   IF (NRPL(I).NE.3.) GO TO 1000
      GO TO 1090
1000  IF (NRPL(I).NE.4.0) GO TO 1010
      GO TO 1090
1010  IF (NRPL(I).NE.5.) GO TO 1020
      GO TO 1090
1020  IF (NRPL(I).NE.6.) GO TO 1030
      GO TO 1090
1030  IF (NRPL(I).NE.7.0) GO TO 1040
      GO TO 1090
1040  IF (NRPL(I).NE.8.) GO TO 1050
      GO TO 1090
1050  IF (NRPL(I).NE.9.) GO TO 1060
      GO TO 1090
1060  IF (NRPL(I).NE.10.0) GO TO 1070
      GO TO 1090
1070  IF (NRPL(I).NE.11.) GO TO 1080
      GO TO 1090
1080  CONTINUE
      NRPL(I)=NXRPL(I)+1.
1090  CONTINUE
      EIW(I)=CW(I)+IF(I)*DW(I)
      RC(I)=1.35*IC(I)
      SV(I)=.8*IC(I)
      WXO(I)=.35*SHPM(I)
      LAMFR(I)=1./MTBF(I)
      RELY(I)=EXP((-LAMFR(I))*AFHPF)
      AVAIL(I)=MTEMA(I)/(MTBMA(I)+MDT(I))
      LCC(I)=(RDC(I)+IC(I)+HL*(YOC(I)+YMC(I))
     1      +NRPL(I)*(RC(I)-SV(I)))*.0001
      MAINT(I)=MDT(I)/AFHPF
1100  CONTINUE
      WRITE (6,2100) (DW(I),I=1,6)
      WRITE (8,2100) (DW(I),I=1,6)
      WRITE (6,2110) (LCC(I),I=1,6)
      WRITE (8,2110) (LCC(I),I=1,6)
      WRITE (6,2120) (MTBR(I),I=1,6)
      WRITE (8,2120) (MTBR(I),I=1,6)
      WRITE (6,2130) (NRPL(I),I=1,6)
      WRITE (8,2130) (NRPL(I),I=1,6)
```

```
      WRITE (6,2140) (RDC(I),I=1,6)
      WRITE (8,2140) (RDC(I),I=1,6)
      WRITE (6,2150) (IC(I),I=1,6)
      WRITE (8,2150) (IC(I),I=1,6)
      WRITE (6,2160) (YMC(I),I=1,6)
      WRITE (8,2160) (YMC(I),I=1,6)
      WRITE (6,2170) (YOC(I),I=1,6)
      WRITE (8,2170) (YOC(I),I=1,6)
      WRITE (6,2180) (RC(I),I=1,6)
      WRITE (8,2180) (RC(I),I=1,6)
      WRITE (6,2190) (SV(I),I=1,6)
      WRITE (8,2190) (SV(I),I=1,6)
      WRITE (6,2200) (AVAIL(I),I=1,6)
      WRITE (8,2200) (AVAIL(I),I=1,6)
      WRITE (6,2210) (RELY(I),I=1,6)
      WRITE (8,2210) (RELY(I),I=1,6)
      WRITE (6,2220) (MAINT(I),I=1,6)
      WRITE (8,2220) (MAINT(I),I=1,6)
      WRITE (6,2230) (SHPM(I),I=1,6)
      WRITE (8,2230) (SHPM(I),I=1,6)
      WRITE (6,2090) NENG
      WRITE (8,2090) NENG
      DO 1230 I=1,6
      DWM(I)=CW(I)*FLOAT(NENG)
      ICM(I)=IC(I)*FLOAT(NENG)
      SHPMM(I)=SHPM(I)*FLOAT(NENG)
      RDCM(I)=RDC(I)*FLOAT(NENG)
      MTBRM(I)=MTBR(I)
      YMCM(I)=YMC(I)*FLOAT(NENG)
      YOCM(I)=YOC(I)*FLOAT(NENG)
      NRPLM(I)=((HL/MTBR(I))-1.)*FLOAT(NENG)
      NXRPLM(I)=((AINT((HL)/MTBR(I)))-1.)*FLOAT(NENG)
      IF (NRPLM(I).NE.1.0) GO TO 1110
      GO TO 1220
 1110 IF (NRPLM(I).NE.2.) GO TO 1120
      GO TO 1220
 1120 IF (NRPLM(I).NE.3.) GO TO 1130
      GO TO 1220
 1130 IF (NRPLM(I).NE.4.0) GO TO 1140
      GO TO 1220
 1140 IF (NRPLM(I).NE.5.) GO TO 1150
      GO TO 1220
 1150 IF (NRPLM(I).NE.6.) GO TO 1160
      GO TO 1220
 1160 IF (NRPLM(I).NE.7.0) GO TO 1170
      GO TO 1220
 1170 IF (NRPLM(I).NE.8.) GO TO 1180
      GO TO 1220
```

```
1180  IF (NRPLM(I).NE.9.) GO TO 1190
      GO TO 1220
1190  IF (NRPLM(I).NE.10.0) GO TO 1200
      GO TO 1220
1200  IF (NRPLM(I).NE.11.) GO TO 1210
      GO TO 1220
1210  CONTINUE
      NRPLM(I)=(NXRPLM(I)+1.)
1220  CONTINUE
      EIWM(I)=EIW(I)*FLOAT(NENG)
      RCM(I)=1.35*ICM(I)
      SVM(I)=.8*ICM(I)
      WXOM(I)=.35*SHPMM(I)
      LAMFR(I)=(1./MTBF(I))
      RELYM(I)=EXP((-LAMFR(I))*AFHPF)
      AVAILM(I)=(MTBMA(I)/(MTBMA(I)+MDT(I)))
      LCCM(I)=(FLOAT(NENG))*(RDC(I)+IC(I)+HL*(YOC(I)
     1+YMC(I))+NRPL(I)*(RC(I)-SV(I)))*.0001
      MAINTM(I)=(MDT(I)/AFHPF)
1230  CONTINUE
      WRITE (6,2100)  (DWM(I),I=1,6)
      WRITE (8,2100)  (DWM(I),I=1,6)
      WRITE (6,2110)  (LCCM(I),I=1,6)
      WRITE (8,2110)  (LCCM(I),I=1,6)
      WRITE (6,2120)  (MTBRM(I),I=1,6)
      WRITE (8,2120)  (MTBRM(I),I=1,6)
      WRITE (6,2130)  (NRPLM(I),I=1,6)
      WRITE (8,2130)  (NRPLM(I),I=1,6)
      WRITE (6,2140)  (RDCM(I),I=1,6)
      WRITE (8,2140)  (RDCM(I),I=1,6)
      WRITE (6,2150)  (ICM(I),I=1,6)
      WRITE (8,2150)  (ICM(I),I=1,6)
      WRITE (6,2160)  (YMCM(I),I=1,6)
      WRITE (8,2160)  (YMCM(I),I=1,6)
      WRITE (6,2170)  (YOCM(I),I=1,6)
      WRITE (8,2170)  (YOCM(I),I=1,6)
      WRITE (6,2180)  (RCM(I),I=1,6)
      WRITE (8,2180)  (RCM(I),I=1,6)
      WRITE (6,2190)  (SVM(I),I=1,6)
      WRITE (8,2190)  (SVM(I),I=1,6)
      WRITE (6,2200)  (AVAILM(I),I=1,6)
      WRITE (8,2200)  (AVAILM(I),I=1,6)
      WRITE (6,2210)  (RELYM(I),I=1,6)
      WRITE (8,2210)  (RELYM(I),I=1,6)
      WRITE (6,2220)  (MAINTM(I),I=1,6)
      WRITE (8,2220)  (MAINTM(I),I=1,6)
      WRITE (6,2230)  (SHPMM(I),I=1,6)
      WRITE (8,2230)  (SHPMM(I),I=1,6)
```

```
      WRITE (6,2450) ESHPR
      WRITE (8,2450) ESHPR
      WRITE (6,2240)
      READ (5,*) ENGSEL
      CALL FRTCMS ('CLRSCRN 6')
C*****************************************************************************
C     6.3 REVISE GROSS WEIGHT AND POWER REQUIRED                             *
C*****************************************************************************
      EW=W6A+W6B
      EWNEW=EIWM(ENGSEL)+WXOM(ENGSEL)
      WGNEW=EWNEW+REVWG-EW
      WRITE (6,2300) REVWG,WGNEW
      WRITE (8,2300) REVWG,WGNEW
      COMPAR=1.-REVWG/WGNEW
      IF (COMPAR.LE..1) GO TO 1250
      WG=WGNEW
      DO 1240 I=1,6
      DWM(I)=0.
      LCCM(I)=0.
      MTBRM(I)=0.
      NRPLM(I)=0.
      RDCM(I)=0.
      ICM(I)=0.
      YMCM(I)=0.
      YOCM(I)=0.
      RCM(I)=0.
      SVM(I)=C.
      AVAILM(I)=0.
      RELYM(I)=0.
      MAINTM(I)=0.
      SHPMM(I)=0.
      NXRPLM(I)=0.
      EIWM(I)=0.
      WXOM(I)=0.
      LCCM(I)=0.
1240  CONTINUE
      TRIP3=3.
      GO TO 120
1250  IF (COMPAR.GE.-.1) GO TO 1270
      WG=WGNEW
      DO 1260 I=1,6
      DWM(I)=0.
      LCCM(I)=0.
      MTBRM(I)=0.
      NRPLM(I)=0.
      RDCM(I)=0.
      ICM(I)=0.
      YMCM(I)=0.
```

```
      YOCM(I)=0.
      RCM(I)=0.
      SVM(I)=0.
      AVAILM(I)=0.
      RELYM(I)=0.
      MAINTM(I)=0.
      SHPMM(I)=0.
      NXRPLM(I)=0.
      EIWM(I)=0.
      WXOM(I)=0.
      LCCM(I)=0.
 1260 CONTINUE
      TRIP3=3.
      GO TO 120
 1270 CONTINUE
C**********************************************************************
C     7.1 DETERMINE FUEL FLOW RATES                                  *
C**********************************************************************
      WRITE (6,2250)
      WRITE (8,2250)
      WFM=SFCM(ENGSEL)*SHPM(ENGSEL)*FLOAT(NENG)
      WFC=SFCC(ENGSEL)*SHPC(ENGSEL)*FLOAT(NENG)
      WFN=SFCN(ENGSEL)*SHPN(ENGSEL)*FLOAT(NENG)
      WRITE (6,2260) WFM,WFN,WFC
      WRITE (8,2260) WFM,WFN,WFC
C**********************************************************************
C     7.2 DETERMINE FUEL FLOW PER HORSEPOWER                         *
C**********************************************************************
      BETA=(WFM-WFC)/((SHPM(ENGSEL)-
     1      SHPC(ENGSEL))*FLOAT(NENG))
      ALPHA=(BETA*SHPM(ENGSEL)-BETA*
     1      SHPC(ENGSEL))*FLOAT(NENG)
C**********************************************************************
C     7.3 COMPUTE THE INTERCEPT AT SPECIFICATION CONDITIONS          *
C**********************************************************************
      PRESS=2116.22*(1.-CONST*PA)**5.2561
      TEMP=518.688*(1.-CONST*PA)
      THETA=TEMP/518.688
      DELTA=PRESS/2116.22
      ZHI=ALPHA*DELTA*SQRT(THETA)
      WRITE (6,2280) TEMP,PRESS,ALPHA,THETA,DELTA,ZHI
      WRITE (8,2280) TEMP,PRESS,ALPHA,THETA,DELTA,ZHI
C**********************************************************************
C     7.4 DETERMINE THE ZERO VELOCITY HORSEPOWER INCREMENT           *
C**********************************************************************
      PSHP=(FLOAT(NENG)*ALPHA*DELTA*SQRT(THETA))/BETA
      WRITE (6,2730)
      READ (5,*) TYPEM
```

```
      IF (TYPEM.NE.1.) GO TO 1280
      FSLT=45.9
      GO TO 1300
1280  IF (TYPEM.NE.2.) GO TO 1290
      FSLT=50.1
      GO TO 1300
1290  CONTINUE
      FSLT=67.2
1300  CONTINUE
      IF (TRIP5.EQ.5.) GO TO 1370
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2290) PSHP
      WRITE (8,2290) PSHP
C*********************************************************************
C     ** START OF DISSPLA SPECIFIC PORTION OF THE PROGRAM            *
C*********************************************************************
      CALL HWROT('AUTO')
      CALL HWSCAL('SCREEN')
      CALL PAGE (11.,8.5)
      CALL NOBRDR
      CALL AREA2D (9.,6.)
      CALL SWISSL
      CALL THKCRV (.02)
      CALL CROSS
      CALL LINESP (2.5)
      CALL SHDCHR (90.,1,.002,1)
      CALL THKFRM (.15)
      CALL INTAXS
      CALL XAXEND ('NOENDS')
      CALL XTICKS (2)
      CALL YTICKS (5)
      CALL YAXANG (0.)
      CALL HEIGHT (.1)
      CALL MYLEGN (' ',1)
      CALL LINES ('INDUCED POWER$',IHP,1)
      CALL LINES ('PROFILE POWER$',IHP,2)
      CALL LINES ('PARASITE POWER$',IHP,3)
      CALL LINES ('HISPEED EFFECTS$',IHP,4)
      CALL LINES ('TOTAL POWER$',IHP,5)
      CALL RESET ('HEIGHT')
      CALL XNAME ('FORWARD VELOCITY(KNOTS)$',100)
      CALL YNAME ('REQUIRED HORSEPOWER$',100)
      CALL HEADIN ('POWER VS. VELOCITY AT ALTITUDE$',
     1            -100,1.5,1)
      IF (ENGSEL.NE.1.) GO TO 1310
      CALL GRAF (0.,10.,(MAXV+50.),(-500.*FLOAT(NENG)),500.,
     1              (1000.*FLOAT(NENG)))
      GO TO 1360
```

```
1310  IF (ENGSEL.NE.2.) GC TO 1320
      CALL GRAF (C.,10.,(MAXV+50.),(-1000.*FLCAT(NENG)),500.,
     1              (1500.*FLOAT(NENG)))
      GO TO 1360
1320  IF (ENGSEL.NE.3.) GO TO 1330
      CALL GRAF (C.,10.,(MAXV+50.),(-1500.*FLOAT(NENG)),500.,
     1              (2500.*FLOAT(NENG)))
      GO TO 1360
1330  IF (ENGSEL.NE.4.) GO TO 1340
      CALL GRAF (C.,10.,(MAXV+50.),(-1500.*FLCAT(NENG)),500.,
     1              (2500.*FLOAT(NENG)))
      GO TO 1360
1340  IF (ENGSEL.NE.5.) GO TO 1350
      CALL GRAF (C.,10.,(MAXV+50.),(-1500.*FLOAT(NENG)),500.,
     1              (3500.*FLOAT(NENG)))
      GO TO 1360
1350  CONTINUE
      CALL GRAF (C.,10.,(MAXV+50.),(-1500.*FLCAT(NENG)),
     1         500.,(4500.*FLOAT(NENG)))
1360  CONTINUE
      CALL POLY3
      CALL DCT
      CALL LEGLIN
      CALL CURVE (KNOTS,PIY,N,0)
      CALL RESET ('DOT')
      CALL DASH
      CALL LEGLIN
      CALL CURVE (KNOTS,POY,N,0)
      CALL RESET ('DASH')
      CALL CHNDOT
      CALL LEGLIN
      CALL CURVE (KNOTS,PPY,N,0)
      CALL RESET ('CHNDOT')
      CALL CHNDSH
      CALL LEGLIN
      CALL CURVE (KNOTS,PCMPA,N,0)
      CALL RESET ('CHNDSH')
      CALL LEGLIN
      CALL CURVE (KNOTS,PTY,N,0)
      CALL LEGEND (IHP,5,3.7,4.25)
      CALL RLMESS ('X--PSHP$',100,0.,-PSHP)
      CALL RLMESS ('X-MAX SHP$',100,0.,SHPMM(ENGSEL))
      CALL RLMESS ('X-CRUISE$',100,VCR,0.)
      CALL BLREC (3.5,4.15,2.,1.55,1.)
      CALL RESET ('THKCRV')
      CALL DCT
      CALL GRID (2,1)
      CALL RESET ('DOT')
```

```
      CALL ENDPL (0)
C*****************************************************************************
C     ** END OF DISSPLA SPECIFIC PORTION OF THE PROGRAM                      *
C*****************************************************************************
      WRITE (6,2310) PSHP
      WRITE(8,1410)PSHP
      GO TO 1380
1370  CONTINUE
      WRITE (6,2770)
1380  CONTINUE
C*****************************************************************************
C     7.5 DETERMINE THE MAXIMUM RANGE VELOCITY                               *
C*****************************************************************************
      WRITE (6,2320)
      READ (5,*) VMAXR
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2760)
      READ (5,*) VELMAX
      CALL FRTCMS ('CLRSCRN 6')
C*****************************************************************************
C     7.6 DETERMINE THE MAXIMUM ENDURANCE VELOCITY                           *
C*****************************************************************************
      WRITE (6,2330)
      READ (5,*) VMAXE
      CALL FRTCMS ('CLRSCRN 6')
      WRITE (6,2340)
      READ (5,*) RSHPME
      RSHRME=PSHP+RSHPME
      WFME=RSHRME*BETA
      CALL FRTCMS ('CLRSCRN 6')
C*****************************************************************************
C     7.7 DETERMINE THE POWER REQUIRED AND FUEL FLOW RATE AT                 *
C         SPECIFICATION CRUISE VELOCITY                                      *
C*****************************************************************************
      WRITE (6,2350)
      READ (5,*) RSHPC
      RSHPRC=PSHP+RSHPC
      WFCR=RSHPRC*BETA
      CALL FRTCMS ('CLRSCRN 6')
      IF (TRIP4.EQ.4.) GO TO 1390
1390  CONTINUE
C*****************************************************************************
C     7.8 DETERMINE THE TOTAL FUEL REQUIREMENTS                              *
C*****************************************************************************
      FW=(.05*WFN)*2.+(WFCR*RNGMAX/VCR)+.25*WFME
      GALIN=FW/6.5
      GALOUT=0.
      WRITE (6,2380) FW
```

```
      WRITE (8,2380) FW
C*************************************************************************
C     8.1 COMPUTE DESIGN GROSS AND EMPTY WEIGHT                          *
C*************************************************************************
      DWG=WGNEW+FW-FUEL
      WRITE (6,2390) DWG,REVWG
      WRITE (8,2390) DWG,WG
      SIM=1.-DWG/WG
      IF (SIM.LT..1) GO TO 1400
      WRITE (6,2420)
      WRITE (8,2420)
      WE=DWG-FW-USELOD
      FUEL=FW
      TRIP1=1.
      TRIP2=2.
      TRIP3=3.
      TRIP4=4.
      GO TO 120
1400  CONTINUE
      EXCESS=REVWG-DWG
      IF (EXCESS.LE.0.) GO TO 1430
      WRITE (6,2400) EXCESS
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.NE.1.) GO TO 1410
      FWNEW=FW+EXCESS
      RNGNMX=(FWNEW-.05*WFN-.25*WFME-.05*WFN)*VCR/WFC
      NEWUSE=USELOD
      DWG=DWG+EXCESS
      GO TO 1440
1410  IF (ANS.NE.2.) GO TO 1420
      NEWUSE=USELOD+EXCESS
      RNGNMX=RNGMAX
      DWG=DWG+EXCESS
1420  CONTINUE
      WRITE (6,2410)
      READ (5,*) FWNEW
      NEWUSE=EXCESS-FWNEW+USELOD
      RNGNMX=(FWNEW-.05*WFN-.25*WFME-.05*WFN)*VCR/WFC
      DWG=DWG+EXCESS
      GO TO 1440
1430  RNGNMX=RNGMAX
      NEWUSE=USELOD
1440  CONTINUE
      FW=FWNEW
C*************************************************************************
C     8.2 DETERMINE BEST RATE OF CLIMB                                   *
C*************************************************************************
```

```
1450  CONTINUE
      PAVAIL=(SHPMM(ENGSEL)-10.)/(.1*FLOAT(NENG-1)+1.03)
      WRITE (6,2460)
      READ (5,*) VVERT
      RCLIMB=VVERT
      CALL FRTCMS ('CLRSCRN 6')
      VVERT=VVERT/60.
      VFWD=VMAXE*1.151*5280./3600.
      VINEW=SQRT(DWG/(2.*RHOSL*AREAMR))
      EFPAVF=2.*EFPAFF
      VITNEW(1)=1.
      VITNEW(2)=2.*VVERT
      VITNEW(3)=VFWD**2+VVERT**2
      VITNEW(4)=0.
      VITNEW(5)=-VINEW**4
      NDEG=4
      CALL ZPCLR (VITNEW,NDEG,ZCMPLX,IER)
      VTNEW=ZCMPLX(3)
      PC=DWG*VVERT
      PC=PC/550.
      MU=VFWD/VTIP
      MUTR=VFWD/VTIPTR
      PPC=(.5*RHOSL*EFPAVF*VVERT**3)+(.5*RHOSL*EFPAFF*VFWD**3)
      PPC=PPC/550.
      POC=.125*RHOSL*CDO*SIGMA*AREAMR*VTIP**3*(1.+4.3*MU**2)
      POC=POC/550.
      PIVERT=(1./B)*DWG*VTNEW
      PIVERT=PIVERT/550.
      PTVERT=POC+PIVERT+PC+PPC
      POTR=.125*SIGTR*CDOTR*RHOSL*AREATR*(VTIPTR**3)
      POTRF=(1.+4.3*MUTR**2)*POTR
      POTRF=POTRF/550.
      PPF=.5*RHOSL*(VFWD**3)*EFPAFF
      PPF=PPF/550.
      PO=.125*SIGMA*CDO*RHOSL*AREAMR*(VTIP**3)
      POF=(1.+4.3*MU**2)*PO
      POF=POF/550.
      VI=SQRT(DWG/(2.*RHOSL*AREAMR))
      VIT=VI*SQRT((-(VFWD**2/(2.*VI**2)))
     1    +SQRT(((VFWD**2/(2.*VI**2))**2)+1.))
      PITLF=(1./B)*DWG*VIT
      PITLF=PITLF/550.
      PTF=PITLF+POF+PPF
      TTR=((PTF*550.)/(OMEGA*LTR))
      CTTR=TTR/(AREAMR*(VTIPTR**2)*RHOSL)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      VITR=SQRT(TTR/(2.*RHOSL*AREATR))
      VITTR=VITR*SQRT((-(VFWD**2/(2.*VITR**2)))
```

```
     1        +SQRT(((VFWD**2/(2.*VITR**2))**2)+1.))
      PITLTF=(1./B)*TTR*VITTR
      PITLTF=PITLTF/550.
      PTTRF=PITLTF+POTRF
      PTAVAL=PTTRF+PTVERT
      WRITE (6,2470) PAVAIL,PTAVAL,PIVERT
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.EQ.1.) GO TO 1450
      VVERT=VVERT*60.
      WRITE (6,2480) RCLIMB
      WRITE (8,2480) RCLIMB
C*************************************************************************
C     8.3 COMPUTE MAXIMUM HOVER ALTITUDE, IGE                            *
C*************************************************************************
1460  CONTINUE
      WRITE (6,2500)
      READ (5,*) ALT
      CALL FRTCMS ('CLRSCRN 6')
      PALT=2116.22*(1.-CONST*ALT)**5.2561
      DELTA=PALT/2116.22
      TALT=518.688*(1.-CONST*ALT)
      THETA=TALT/518.688
      CALL FRTCMS ('CLRSCRN 6')
      RHOMH=.0023769*(1.-CONST*ALT)**4.2561
      CTH=DWG/(AREAMR*RHOMH*VTIP**2)
      BH=1.-SQRT(2.*CTH)/FLOAT(BLADES)
      PITLH=(1./BH)*(DWG**1.5/SQRT(2.*RHOMH*AREAMR))
      PPOGEH=-.1276*(H/D)**4+.708*(H/D)**3-1.4569*(H/D)**2+1.3432*(H/D)+
     1.5147
      POH=.125*SIGMA*CDO*RHOMH*AREAMR*VTIP**3
      PTH=PITLH+POH
      TTR=PTH/(OMEGA*LTR)
      VTIPTR=OMEGTR*RTR
      CTTR=TTR/(AREATR*RHOMH*VTIPTR**2)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      PITLTR=(1./BTR)*(TTR**1.5/SQRT(2.*RHOMH*AREATR))
      POTR=.125*SIGTR*CDOTR*RHOMH*AREATR*(VTIPTR**3)
      PTTRH=PITLTR+POTR
      PTACH=PTH+PTTRH
      PTACH=PTACH/550.
      PAVAIL=((SHPMM(ENGSEL)-10.)/(.1*FLOAT(NENG-1)+1.03))*DELTA/SQRT(TH
     1ETA)
      WRITE (6,2490) PAVAIL,PTACH
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.EQ.1.) GO TO 1460
      WRITE (6,2530) ALT
```

```
      WRITE (8,2530) ALT
1470  CONTINUE
C*********************************************************************
C     8.4 COMPUTE SERVICE CEILING                                    *
C*********************************************************************
      WRITE (6,2510)
      READ (5,*) ALTSC
      CALL FRTCMS ('CLRSCRN 6')
      PALT=2116.22*(1.-CONST*ALTSC)**5.2561
      DELTA=PALT/2116.22
      TALT=518.688*(1.-CONST*ALTSC)
      THETA=TALT/518.688
      RHOSC=.0023769*(1.-CONST*ALTSC)**4.2561
      PAVAIL=((SHPN(ENGSEL)*FLOAT(NENG)-10.)/(.1*FLOAT(NENG-1)+1.03))*DE
     1LTA/SQRT(THETA)
      VVERT=100./60.
      VFWD=VMAXE*1.151*5280./3600.
      VINEW=SQRT(DWG/(2.*RHOSC*AREAMR))
      VITNEW(1)=1.
      VITNEW(2)=2.*VVERT
      VITNEW(3)=VFWD**2+VVERT**2
      VITNEW(4)=0.
      VITNEW(5)=-VINEW**4
      CALL ZPCLR (VITNEW,NDEG,ZCMPLX,IER)
      VTNEW=ZCMPLX(3)
      PC=DWG*VVERT
      PC=PC/550.
      PPC=(.5*RHOSC*EFPAVF*VVERT**3)+(.5*RHOSC*EFPAFF*VFWD**3)
      PPC=PPC/550.
      POC=.125*RHOSC*CDO*SIGMA*AREAMR*VTIP**3
      POC=POC/550.
      PIVERT=(1./8)*DWG*VTNEW
      PIVERT=PIVERT/550.
      PTVERT=POC+PIVERT+PC+PPC
      MUTR=VFWD/VTIPTR
      POTR=.125*SIGTR*CDOTR*RHOSC*AREATR*(VTIPTR**3)
      POTRF=(1.+4.3*MUTR**2)*POTR
      POTRF=POTRF/550.
      PPF=.5*RHOSC*(VFWD**3)*EFPAFF
      PPF=PPF/550.
      MU=VFWD/VTIP
      PO=.125*SIGMA*CDO*RHOSC*AREAMR*(VTIP**3)
      POF=(1.+4.3*MU**2)*PO
      POF=POF/550.
      VI=SQRT(DWG/(2.*RHOSC*AREAMR))
      VIT=VI*SQRT((-(VFWD**2/(2.*VI**2)))
     1            +SQRT(((VFWD**2/(2.*VI**2))**2)+1.))
      PITLF=(1./8)*DWG*VIT
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```
      PITLF=PITLF/550.
      PTF=PITLF+PCF+PPF
      TTR=((PTF*550.)/(OMEGA*LTR))
      CTTR=TTR/(AREATR*(VTIPTR**2)*RHOSC)
      BTR=1.-SQRT(2.*CTTR)/FLOAT(BLADTR)
      VITR=SQRT(TTR/(2.*RHOSC*AREATR))
      VITTR=VITR*SQRT((-(VFWD**2/(2.*VITR**2)))
     1            +SQRT(((VFWD**2/(2.*VITR**2))**2)+1.))
      PITLTF=(1./B)*TTR*VITTR
      PITLTF=PITLTF/550.
      PTTRF=PITLTF+POTRF
      PTAVAL=PTTRF+PTVERT
      WRITE (6,2540) PAVAIL,PTAVAL
      READ (5,*) ANS
      CALL FRTCMS ('CLRSCRN 6')
      IF (ANS.EQ.1.) GO TO 1470
      WRITE (6,2520) ALTSC
      WRITE (8,2520) ALTSC
C*********************************************************************
C     9.1 MAKE FINAL CHECK FOR SPECIFICATION COMPLIANCE               *
C*********************************************************************
      WRITE (6,2550) CREW,PEOPLE,SPCLOD,NEWUSE,SC,ALTSC,HOVIGE,ALT,VCR,V
     1MAXR,MAXV,VELMAX,VMAXE,VMAXR,RBS,RNGMAX,RNGMMX,MAXRC,RCLIMB,NENG
      WRITE (8,2550) CREW,PEOPLE,SPCLOD,NEWUSE,SC,ALTSC,HOVIGE,ALT,VCR,V
     1MAXR,MAXV,VELMAX,VMAXE,VMAXR,RBS,RNGMAX,RNGMMX,MAXRC,RCLIMB,NENG
      IF (ENGSEL.NE.1.) GO TO 1480
      WRITE (6,2560)
      WRITE (8,2560)
      GO TO 1530
1480  IF (ENGSEL.NE.2.) GO TO 1490
      WRITE (6,2570)
      WRITE (8,2570)
      GO TO 1530
1490  IF (ENGSEL.NE.3.) GO TO 1500
      WRITE (6,2580)
      WRITE (8,2580)
      GO TO 1530
1500  IF (ENGSEL.NE.4.) GO TO 1510
      WRITE (6,2590)
      WRITE (8,2590)
      GO TO 1530
1510  IF (ENGSEL.NE.5.) GO TO 1520
      WRITE (6,2600)
      WRITE (8,2600)
      GO TO 1530
1520  CONTINUE
      WRITE (6,2610)
      WRITE (8,2610)
```

```
      GO TO 1530
1530  CONTINUE
      WRITE (6,2620)  SHPMM(ENGSEL),GWSPEC,DWG,WE,GALIN,GALOJT,CHORD,RSPE
     1C,R,BLADES,CDO,OMEGA,SIGMA,CHORDT,RTR,BLADTR
      WRITE (8,2620)  SHPMM(ENGSEL),GWSPEC,DWG,WE,GALIN,GALOUT,CHORD,RSPE
     1C,R,BLADES,CDO,OMEGA,SIGMA,CHORDT,RTR,BLADTR
      WRITE (6,2630)  CDOTR,OMEGTR,SIGTR,STT,FSLTS,FSLT,EFPAFF,EFPAVF
      WRITE (8,2630)  CDOTR,OMEGTR,SIGTR,STT,FSLTS,FSLT,EFPAFF,EFPAVF
C***********************************************************************
C     10.1  BASES FOR COST ESTIMATING RELATIONSHIPS                    *
C***********************************************************************
      Q=100.
      C1=-12538.+101.*W1*(Q**(-.074))*IR
      C2A=102.*W2A*(Q**(-.074))*IR
      C2B=759.*(W2B**.848)*(Q**(-.286))*IR
      C3=860.*(W3**.848)*(Q**(-.286))*IR
      IF (LG.NE.2.) GO TO 1540
      C4=85.*W4*(C**(-.2176))*IR
      GO TO 1550
1540  CONTINUE
      C4=C3*W4/W3*IR
1550  CONTINUE
      C5=893.*(W5**.848)*(Q**(-.286))*IR
      C6A=ICM(ENGSEL)*IR*1000.
      C6B=19946.+83.*W6B*(Q**(-.074))*IR
      C6C=201.*W6C*(Q**(-.0896))*IR
      C7=156.*W7*(Q**(-.0896))*IR
      C8=243.*W8*(Q**(-.0896))*IR
      C9=125.*W9*(Q**(-.0896))*IR
      C10=91.*W10*(Q**(-.0896))*IR
      C11=143.*W11*(Q**(-.0896))*IR
      C12=6847.+125.*W12*(Q**(-.0896))*IR
      C13=69.*W13*(Q**(-.0896))*IR
      C14=213.*W14*(Q**(-.0896))*IR
      C15=C3*W15/W3*IR
      TOTALC=C1+C2A+C2B+C3+C4+C5+C6A+C6B+C6C+C7+C8+C9+C10+C11+C12+C13+C1
     14+C15
      WRITE (6,2810)  C1,C2A,C2B,C3,C4,C5,C6A,C6B,C6C,C7,C8,C9,C10,C11,C1
     12,C13,C14,C15,TOTALC
      WRITE (8,2810)  C1,C2A,C2B,C3,C4,C5,C6A,C6B,C6C,C7,C8,C9,C10,C11,C1
     12,C13,C14,C15,TOTALC
      CALL DCNEPL
      STOP
C***********************************************************************
1560  FORMAT (////39H WHAT TYPE OF MACHINE ARE YOU NOW USING,/,10X,22H1.
     1  TEK618/DUAL SCREEN,/,10X,12H2.   IBM 3278)
1570  FORMAT (45H ENTER THE SPECIFICATION MAXIMUM GROSS WEIGHT)
1580  FORMAT (47H ENTER THE MANUFACTURERS ESTIMATED EMPTY WEIGHT)
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1590  FORMAT (55H ENTER THE GROSS WEIGHT THAT YOU WANT FOR THE FIRST 80%
     1,9H ESTIMATE)
1600  FORMAT (30H GROSS WEIGHT ESTIMATE          =,F8.2)
1610  FORMAT (54H ENTER THE VALUE OF THE DISC LOADING FOR THE ESTIMATED,
     1/,16H GROSS WEIGHT OF,F9.2,4H LBS)
1620  FORMAT (56H ENTER THE SPECIFICATION MAXIMUM FORWARD VELOCITY(KNOTS
     1))
1630  FORMAT (28H THE ADVANCE RATIO (MU) IS =,F6.4,/)
1640  FORMAT (52H ENTER THE BLADE LOADING FOR THE GIVEN ADVANCE RATIO)
1650  FORMAT (52H ENTER THE NUMBER OF MAIN ROTOR BLADES THAT YOU WANT)
1660  FORMAT (30H1GROSS WEIGHT (LBS)           =,F10.2,/,30H EMPTY WEIGHT
     1 (LBS)            =,F10.2,/,30H SONIC SPEED (FPS)           =,F10.2,
     2/,30H MAXIMUM TIP VELOCITY (FPS)  =,F10.2,/,30H DISK LOADING
     3          =,F10.2,/,30H ROTOR RADIUS (FT)            =,F10.2,/,30H
     4ROTATIONAL VELOCITY (RPS)   =,F10.2,/,30H TIP VELOCITY (FPS)
     5    =,F10.2,/,30H COEFFICIENT OF THRUST        =,F14.6,/,30H ADVANC
     6E RATIO (MU)          =,F12.4,/,30H BLADE LOADING               =,
     7F12.4,/,30H SOLIDITY                     =,F15.7,/,30H NUMBER OF MA
     8IN ROTOR BLADES =,5X,I2,/,30H CHORD MAIN ROTOR BLADE (FT) =,F14.6)
1670  FORMAT (10X,30H       THE ASPECT RATIO IS    =,F11.3,/,10X,30H
     1 THE ROTATIONAL SPEED IS=,F11.3)
1680  FORMAT (10X,39H WHAT ROTATIONAL SPEED DO YOU WANT NOW?)
1690  FORMAT (55H WHAT IS THE COEFFICIENT OF LIFT WITH RESPECT TO ALPHA?
     1,6H(/DEG))
1700  FORMAT (43H WHAT IS THE ZERO LIFT COEFFICIENT OF DRAG?)
1710  FORMAT (30H1GROSS WEIGHT (LBS)           =,F10.2,/,30H EMPTY WEIGHT
     1 (LBS)            =,F10.2,/,30H SONIC SPEED (FPS)           =,F10.2,
     2/,30H MAXIMUM TIP VELOCITY (FPS)  =,F10.2,/,30H DISK LOADING (LBS/
     3SF)       =,F10.2,/,30H ROTOR RADIUS (FT)            =,F10.2,/,30H
     4ROTATIONAL VELOCITY (RPS)   =,F10.2,/,30H TIP VELOCITY (FPS)
     5    =,F10.2,/,30H COEFFICIENT OF THRUST        =,F14.6,/,30H ADVANC
     6E RATIO (MU)          =,F12.4,/,30H BLADE LOADING               =,
     7F12.4,/,30H SOLIDITY                     =,F15.7,/,30H NUMBER OF MA
     8IN ROTOR BLADES =,5X,I2,/,30H CHORD MAIN ROTOR BLADE (FT) =,F11.3,
     9/,30H ASPECT RATIO OF MAIN ROTOR  =,F10.2,/,30H COEFF OF LIFT (AVG
     $)        =,F12.4,/,30H COEFF OF LIFT W/R ALPHA     =,F12.4,/,30H
     $COEFF OF DRAG @ 0 LIFT       =,F12.4)
1720  FORMAT (///35H ENTER THE AMOUNT OF FUEL IN POUNDS)
1730  FORMAT (46H ENTER THE USEFUL LOAD IN POUNDS THAT YOU WANT)
1740  FORMAT (47H ENTER THE NUMBER OF PEOPLE YOU ARE PLANNING ON)
1750  FORMAT (37H ENTER THE NUMBER OF ENGINES YOU WANT)
1760  FORMAT (30H1TIP LOSS FACTOR             =,F16.7,/,30H POWER (INDUC
     1ED)(HP)           =,F10.1,/,30H POWER (PROFILE)(HP)         =,F10.1,
     2/,30H POWER (TOTAL)(HP)          =,F10.1,/,30H EMPTY WEIGHT (LBS)
     3          =,F11.2,/,30H FUEL WEIGHT (LBS)            =,F11.2,/,30H
     4NUMBER OF PEOPLE           =,6X,I2,/,30H USEFUL LOAD (LBS)
     5    =,F11.2,/,30H NUMBER OF ENGINES           =,6X,I2,/,30H ESTIMA
     6TED GROSS WEIGHT(LBS) =,F11.2,/,30H SOLIDITY                     =,
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      7F16.7,/,30H ROTOR RADIUS (FT)              =,F12.3,/,30H HOVER POWER
      8(HP)              =,F10.1,/,30H ROTOR WEIGHT(LBS)              =,F11.2,
      9/,30H TAIL: ROTOR (LBS)               =,F11.2,/,30H      STRUCTURE (L
      $BS)        =,F11.2,/,30H BODY (LBS)                    =,F11.2,/,30H
      $LANDING GEAR (LBS)          =,F11.2)
1770  FORMAT (30H NACELLE (LBS)                  =,F11.2,/,30H PROPULSION:
      1ENGINE (LBS)     =,F11.2,/,30H              DRIVE (LBS)      =,F11.2,
      2/,30H                  FUEL TANKS (LBS)=,F11.2,/,30H FLIGHT CONTROLS (L
      3BS)        =,F11.2,/,30H AUXILLARY POWER (LBS)        =,F11.2,/,30H
      4INSTRUMENTS (LBS)           =,F11.2,/,30H HYDRAULICS (LBS)
      5    =,F11.2,/,30H ELECTRICAL (LBS)              =,F11.2,/,30H AVIONI
      6CS (LBS)               =,F11.2,/,30H FURNISHINGS (LBS)             =,
      7F11.2,/,30H AIR AND ICE (LBS)             =,F11.2,/,30H LOAD AND HAN
      8DLING (LBS)       =,F11.2,///,30H REVISED EMPTY WEIGHT (LBS)  =,F11.
      92,/,30H REVISED GROSS WEIGHT (LBS)  =,F11.2)
1780  FORMAT (////30H FIGURE OF MERIT (%)          =,F7.3)
1790  FORMAT (/46H LOOK AT YOUR FIGURE OF MERIT, IF NOT 70<M<80%,/,10X,5
      15H THEN  1.  RECALCULATE THE ROTOR RADIUS WITH THE NEW DL,/,17X,20
      2H2.  CHANGE THE CHORD,/,17X,11H3.  CHANGE ,23HTHE ROTATIONAL VELOC
      3ITY,/,17X,15H4.  CONTINUE ON)
1800  FORMAT (24H THE OLD GROSS WEIGHT IS,F11.2,/,/,40H DO YOU WANT TO C
      1HANGE THE DISC LOADING?,/,10X,7H1.  YES,/,10X,6H2.  NO)
1810  FORMAT (56H ENTER A NEW DISK LOADING USING THE REVISED GROSS WEIGH
      1T)
1820  FORMAT (37H ENTER THE HEIGHT OF THE ROTOR SYSTEM)
1830  FORMAT (50H USE THE LATEST ESTIMATE OF GROSS WEIGHT AND ENTER,/,34
      1H THE EQUIVALENT FLAT PLATE LOADING)
1840  FORMAT (///43H1                      MAIN ROTOR POWER PROFILE,/,35H
      1                     @ SSL,/,55H
      2   POWER_____________________/,58H AIRSPEED   TIP      INDUCED----PROF
      3ILE    PARASITE    TOTAL,/,58H (KNOTS)    MACH      (SHP)       (SHP)
      4       (SHP)       (SHP))
1850  FORMAT (2X,F7.2,1X,F5.2,1X,F9.2,2X,F9.2,2X,F9.2,2X,F9.2)
1860  FORMAT (/////43H1                      MAIN ROTOR POWER PROFILE,/,49H
      1        AT SPECIFICATION ALTITUDE AND TEMPERATURE,/,55H
      2                    POWER____________________/,58H AIRSPEED   TIP
      3 INDUCED----PROFILE    PARASITE----TOTAL,/,58H (KNOTS)    MACH
      4(SHP)       (SHP)       (SHP)       (SHP))
1870  FORMAT (34H ENTER THE NEW CHORD THAT YOU WANT)
1880  FORMAT (////,29H        TAIL ROTOR RADIUS (FT)=,F8.3)
1890  FORMAT (5X,24H TAIL ROTOR SPEED (RPS)=,F8.3)
1900  FORMAT (5X,24H TAIL ROTOR CDO          =,3X,F9.7)
1910  FORMAT (5X,//34H ENTER NUMBER OF TAIL ROTOR BLADES,//,35H        2
      1    FOR A LIGHT HELICOPTER,/,36H         3-4   FOR A MEDIUM HELICOPT
      2ER,/,35H        4-7    FOR A HEAVY HELICOPTER)
1920  FORMAT (43H ENTER ASPECT RATIO OF TAIL ROTOR (4.5-8.0))
1930  FORMAT (///39H1                  TAIL ROTOR POWER PROFILE,/,27H
      1               @ SSL,/,48H             ______________POWER__________
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     2_________/,47H AIRSPEED  TIP       INDUCED      PROFILE       TOTAL,/,47H
     3 (KNOTS)    MACH      (SHP)      (SHP)        (SHP))
1940  FORMAT (///39H1                 TAIL ROTOR POWER PROFILE,/,47H        A
     1T SPECIFICATION ALTITUDE AND TEMPERATURE,/,48H
     2    POWER_____________________/,47H AIRSPEED  TIP     INDUCED-----PRO
     3FILE      TOTAL,/,47H (KNOTS)    MACH      (SHP)      (SHP)       (SHP
     4))
1950  FORMAT (2X,F7.2,1X,F5.2,1X,F9.2,2X,F9.2,2X,F9.2)
1960  FORMAT (/////42H TOTAL POWER FOR THE AIRCRAFT TO HOVER IS=,F10.2)
1970  FORMAT (///42H1                   TOTAL ROTOR POWER PROFILE,/,32H
     1                     @ SSL,/,8X,55H                 ________________POWER_
     2_____________________/,57H AIRSPEED    INDUCED     PROFILE
     3PARASITE----COMP---------,6H TOTAL,/,57H (KNOTS)       (SHP)        (SHP
     4)       (SHP)      (SHP)      ,6H (SHP))
1980  FORMAT (2X,F7.2,1X,F9.2,2X,F9.2,2X,F9.2,2X,F9.2,2X,F9.2)
1990  FORMAT (///42H1                   TOTAL ROTOR POWER PROFILE,/,48H
     1   AT SPECIFICATION ALTITUDE AND TEMPERATURE,/,8X,55H
     2--------POWER________________________________/,57H AIRSPEED     INDUCE
     3D     PROFILE     PARASITE----COMP--------,6H TOTAL,/,57H (KNOTS)
     4 (SHP)       (SHP)       (SHP)       (SHP)      ,6H (SHP))
2000  FORMAT (36H THE REQUIRED SHAFT HORSEPOWER IS  =,F10.2)
2010  FORMAT (///4H FOR,I2,41H ENGINE(S), THE REQUIRED SHAFT HORSEPOWER,
     14H IS=,F10.2)
2020  FORMAT (28H YOU PRESENTLY HAVE SELECTED,1X,I2,1X,7HENGINES)
2030  FORMAT (53H DO YOU WANT TO CHANGE THE NUMBER OF ENGINES SELECTED,/
     1,15X,6H1. YES,/,15X,5H2. NO)
2040  FORMAT (42H ENTER THE NUMBER OF ENGINES THAT YOU WANT)
2050  FORMAT (54H ENTER THE NUMBER OF AVERAGE FLIGHT HOURS PER YEAR PER,
     19H AIRFRAME)
2060  FORMAT (52H ENTER THE NUMBER OF AVERAGE FLIGHT HOURS PER FLIGHT)
2070  FORMAT (46H ENTER THE AVERAGE AIRFRAME SERVICE LIFE YEARS)
2080  FORMAT (51H1                        ENGINE SELECTION CRITERIA,/,2
     14X,47H         ------------ 1 ENGINE ---------------,/,24X,46H
     2 A        B        C        D        E        F)
2090  FORMAT (//51H                         ENGINE SELECTION CRITERIA,/
     1,24X,15H      ---------,I2,26H ENGINE(S) --------------,/,24X,46H
     2    A        B        C        D        E        F)
2100  FORMAT (23H POWERPLANT WEIGHT(LB):,6F8.1)
2110  FORMAT (23H LIFE-CYCLE COST($10M):,6F8.2)
2120  FORMAT (23H ENGINE LIFE(HRS):     ,6F8.1)
2130  FORMAT (23H NUMBER OF REPLACEMENT:,6F8.1)
2140  FORMAT (23H R AND D COSTS($K):    ,6F8.1)
2150  FORMAT (23H INTIAL COSTS($K):     ,6F8.1)
2160  FORMAT (23H YEAR MAINT COST($K):  ,6F8.2)
2170  FORMAT (23H YEAR OPERATE COST($K):,6F8.2)
2180  FORMAT (23H REPLACEMENT COST($K): ,6F8.2)
2190  FORMAT (23H SALVAGE VALUE($K):    ,6F8.2)
2200  FORMAT (23H AVAILABILITY(ENG):    ,6F8.4)
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2210  FORMAT (23H RELIABILITY(ENG):        ,6F8.4)
2220  FORMAT (23H MAINTAINABILITY(ENG):  ,6F8.3)
2230  FORMAT (23H PERFORMANCE(SHP-MIL):  ,6F8.1/)
2240  FORMAT (49H SELECT: (1.A)--(2.B)--(3.C)--(4.D)--(5.E)--(6.F))
2250  FORMAT (//51H1  -----------------FUEL FLOW RATES-----------------,/
     1,50H   MILITARY POWER      NORMAL POWER      CRUISE POWER)
2260  FORMAT (3X,F10.2,7X,F10.2,7X,F10.2///////)
2270  FORMAT (30H THE CURRENT CHORD IS             =,F8.2)
2280  FORMAT (30H TEMPERATURE (R)                  =,F10.3,/,30H PRESSURE (PS
     1F)            =,F10.3,/,30H ALPHA AT SSL                  =,F10.3,
     2/,30H THETA AT SPEC ALTITUDE      =,F10.3,/,30H DELTA AT SPEC ALTI
     3TUDE       =,F10.3,/,26H ZERO HORSEPOWER INTERCEPT,/,30H AT SPEC AL
     4TITUDE              =,F10.3)
2290  FORMAT (///43H THE ZERO HORSEPOWER INCREMENT AT ALTITUDE=,F10.3)
2300  FORMAT (//19H OLD GROSS WEIGHT =,F10.2,/,19H NEW GROSS WEIGHT =,F1
     10.2)
2310  FORMAT (///32H THE PHANTOM HORSEPOWER IS    =  ,F10.2)
2320  FORMAT (41H ENTER THE MAX RANGE VELOCITY FROM GRAPHS)
2330  FORMAT (49H ENTER THE MAX ENDURANCE VELOCITY FROM THE GRAPHS)
2340  FORMAT (52H ENTER THE MAX REQUIRED HORSEPOWER FOR MAX ENDURANCE)
2350  FORMAT (49H ENTER THE REQUIRED HORSEPOWER AT CRUISE VELOCITY)
2360  FORMAT (49H ENTER THE MAX RANGE FROM THE SPECIFICATIONS (NM))
2370  FORMAT (35H ENTER THE CRUISE VELOCITY IN KNOTS)
2380  FORMAT (////23H THE FUEL WEIGHT IS   =,F10.2,3HLBS)
2390  FORMAT (32H THE DESIGN GROSS WEIGHT IS    =,F10.2,/,32H THE ESTIMA
     1TED GROSS WEIGHT IS =,F10.2)
2400  FORMAT (30H ADVANTAGEOUS EXCESS WEIGHT IS,F10.1,/,41H WHICH PARAME
     1TER DO YOU WANT TO INCREASE?,/,10X,18H1. FUEL CAPABILITY,/,10X,14H
     22. USEFUL LOAD,/,10X,7H3. BOTH)
2410  FORMAT (24H ENTER THE NEW FUEL LOAD)
2420  FORMAT (54H YOU ARE OVER THE ESTIMATED GROSS WEIGHT AND THEREFORE,
     1/,15H MUST REITERATE)
2430  FORMAT (48H1NOTE THE VELOCITY THAT HAS THE STALL ANGLE LESS,/,31H
     1THAN OR EQUAL TO 12.5 DEGREES ,//,21H  VELOCITY      ANGLE,/,21H
     2 (KNOTS)       (DEG))
2440  FORMAT (1X,F9.2,7X,F6.1)
2450  FORMAT (36H THE REQUIRED SHAFT HORSEPOWER IS  =,F10.2)
2460  FORMAT (///53H COMPUTATION OF THE BEST RATE OF CLIMB, ENTER A GUES
     1S,/,45H FOR THE VERTICAL RATE OF CLIMB (FEET/MINUTE))
2470  FORMAT (37H THE POWER AVAILABLE IS               =,F10.2,/,37H THE T
     1OTAL POWER OF THE AIRCRAFT IS =,F10.2,/,37H THE PROFILE POWER IS
     2              =,F10.2,/,53H_____________________________________
     3_____________,/,49H THE TOTAL POWER SHOULD EQUAL THE POWER AVAILAB
     4LE,/,36H  IF NOT, ENTER A 1, ELSE, ENTER A 2)
2480  FORMAT (////26H THE BEST RATE OF CLIMB IS,F10.2,16H FEET PER MINUT
     1E)
2490  FORMAT (37H THE POWER AVAILABLE IS               =,F10.2,/,37H THE T
     1OTAL POWER OF THE AIRCRAFT IS =,F10.2,/,53H_______________________
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     2_________________________________,/,49H THE TOTAL POWER SHOULD EQUAL
     3THE POWER AVAILABLE,/,35H IF NOT, ENTER A 1, ELSE, ENTER A 2)
2500  FORMAT (///53H COMPUTATION OF THE MAX HOVER ALT (IGE),ENTER A GUES
     1S,/,25H FOR THE ALTITUDE IN FEET)
2510  FORMAT (///51H COMPUTATION FOR THE SERVICE CEILING, ENTER A GUESS,
     1/,25H FOR THE ALTITUDE IN FEET)
2520  FORMAT (///34H THE SERVICE CEILING ALTITUDE IS =,F10.2)
2530  FORMAT (///32H THE HOVER CEILING ALTITUDE IS =,F10.2)
2540  FORMAT (37H THE POWER AVAILABLE IS              =,F10.2,/,37H THE T
     1OTAL POWER OF THE AIRCRAFT IS =,F10.2,/,53H_____________________
     2_________________________________,/,49H THE TOTAL POWER SHOULD EQUAL
     3THE POWER AVAILABLE,/,35H IF NOT, ENTER A 1, ELSE, ENTER A 2)
2550  FORMAT (43H1                        HELICOPTER DESIGN,/,31X,6HAE4
     1306,/,27X,13HFINAL SUMMARY,//,28X,11HPERFORMANCE,//,40X,30HSPECIFI
     2CATION          DESIGN,/,41H CREW...............................
     3....,8X,I2,18X,I2,/,41H INTERNAL LOAD(LBS).....................,F
     410.1,10X,F10.1,/,41H SERVICE CEILING(FT)...................,F10.
     51,10X,F10.1,/,41H HOVER IGE (FT).........................,F10.1,1
     60X,F10.1,/,41H VELOCITY (KTS) CRUISE..................,F10.1,10X,
     7F10.1,/,41H                    MAXIMUM.................,F10.1,10X,F10
     8.1,/,41H                MAX ENDURANCE...........,20X,F10.1,/,41H
     9               MAX RANGE................,20X,F10.1,/,41H
     $       RETREATING BLADE STALL...,20X,F10.1,/,41H MAXIMUM RANGE (NMI
     $)....................,F10.1,10X,F10.1,/,41H MAXIMUM RATE OF CLIMB
     $ (FT/MIN)..........,F10.1,10X,F10.1,/,41H ENGINE - NUMBER.........
     $................,28X,I2)
2560  FORMAT (10X,31HTYPE..............................,29X,1HA)
2570  FORMAT (10X,31HTYPE..............................,29X,1HB)
2580  FORMAT (10X,31HTYPE..............................,29X,1HC)
2590  FORMAT (10X,31HTYPE..............................,29X,1HD)
2600  FORMAT (10X,31HTYPE..............................,29X,1HE)
2610  FORMAT (10X,31HTYPE..............................,29X,1HF)
2620  FORMAT (10X,31HSHP (SSL) MILITARY.............,20X,F10.1,//,29X,8H
     1GEOMETRY,//,41H WEIGHT (LBS) - MAX GROSS................,F10.1,10X
     2,F10.1,/,41H                EMPTY...................,20X,F10.1,/,
     341H FUEL CAPACITY (GAL) -INTERNAL...........,20X,F10.1,/,41H
     4                  EXTERNAL...........,20X,F10.1,/,41H MAIN ROTOR - C
     5HORD (FT)..................,20X,F10.2,/,41H               RADIUS (FT
     6)...............,F10.2,10X,F10.2,/,41H            NUMBER OF BLA
     7DES............,28X,I2,/,41H             DRAG COEFFICIENT.........
     8..,20X,F10.4,/,41H             ROTATIONAL VELOCITY........,20X,F1
     90.2,/,41H              SOLIDITY..................,20X,F10.6,/,41H
     $ TAIL ROTOR - CHORD (FT)...............,20X,F10.2,/,41H
     $       RADIUS (FT)..............,20X,F10.2,/,41H             NUMB
     $ER BLADES..............,28X,I2)
2630  FORMAT (14X,27HDRAG COEFFICIENT...........,20X,F10.4,/,41H
     1      ROTATIONAL VELOCITY........,20X,F10.2,/,41H              SOL
     2IDITY...................,20X,F10.6,/,41H VERTICAL TAIL AREA (FT)..
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     3..............,20X,F10.2,/,41H FUSELAGE LENGTH (FT).............
     4......,F10.2,10X,F10.2,/,41H EQUIVALENT FLAT PLAGE AREA (FT) FORWA
     5RD ,20X,F10.2,/,41H                                  VERTICAL,20X,F
     610.2)
2640  FORMAT (50H ENTER THE SPECIFICATION PRESSURE ALTITUDE IN FEET)
2650  FORMAT (43H ENTER THE SPECIFICATION TEMPERATURE IN (F))
2660  FORMAT (53H FROM THE SPECIFICATIONS SHEET, WHAT IS THE NUMBER OF,6
     1H CREW?)
2670  FORMAT (51H FROM THE SPECIFICATIONS SHEET, WHAT IS THE SERVICE,9H
     1CEILING?)
2680  FORMAT (55H FROM THE SPECIFICATIONS SHEET, WHAT IS THE HOVER (IGE)
     1,9H CEILING?)
2690  FORMAT (51H FROM THE SPECIFICATIONS SHEET, WHAT IS THE MAXIMUM,14H
     1 ROTOR RADIUS?)
2700  FORMAT (51H FROM THE SPECIFICATIONS SHEET, WHAT IS THE MAXIMUM,17H
     1 FUSELAGE LENGTH?)
2710  FORMAT (47H ENTER TYPE OF HELICOPTER FOR WEIGHT ESTIMATION,/,15X,8
     1H1. LIGHT,/,15X,9H2. MEDIUM,/,15X,8H3. HEAVY)
2720  FORMAT (52H ENTER THE MAXIMUM RATE OF CLIMB FROM SPECIFICATIONS)
2730  FORMAT (40H WHICH TYPE HELICOPTER ARE YOU DESIGNING,/,10X,7H1.LIGH
     1T,/,10X,8H2.MEDIUM,/,10X,7H3.HEAVY)
2740  FORMAT (49H YOU HAVE NOT CONVERGED TO WITH 10% OF THE WEIGHT,/,29H
     1 THEREFORE YOU MUST REITERATE)
2750  FORMAT (36H ENTER THE SPECIFICATION USEFUL LOAD)
2760  FORMAT (44H ENTER THE MAXIMUM POSSIBLE FORWARD VELOCITY)
2770  FORMAT (36H HERE IS THE TOTAL POWER VS. FORWARD,16H VELOCITY TABLE
     1,,/,16H NOW GRAPH A FEW,39H POINTS AND EXTRAPOLATE THE NEEDED DATA
     2)
2780  FORMAT (35H ENTER TYPE OF LANDING GEAR DESIRED,//,10X,10H1.  WHEEL
     1S,/,10X,9H2.  SKIDS)
2790  FORMAT (32H WHAT TYPE OF GEAR DO YOU DESIRE,//,10X,9H1.  FIXED,/,1
     10X,15H2.  RETRACTABLE)
2800  FORMAT (33H ENTER THE NUMBER OF LANDING GEAR)
2810  FORMAT (55H1COST ANALYSIS PER VEHICLE (IN DOLLARS FOR 100 A/C RUN)
     1,/,5X,30H ROTOR                       =,F11.2,/,5X,30H TAIL: ROTOR
     2              =,F11.2,/,5X,30H         STRUCTURE            =,F1
     31.2,/,5X,30H BODY                         =,F11.2,/,5X,30H LANDING
     4GEAR                =,F11.2,/,5X,30H NACELLE                       =
     5,F11.2,/,5X,30H PROPULSION: ENGINE           =,F11.2,/,5X,30H
     6         DRIVE          =,F11.2,/,5X,30H               FUEL TANKS
     7  =,F11.2,/,5X,30H FLIGHT CONTROLS              =,F11.2,/,5X,30H AU
     8XILLARY POWER            =,F11.2,/,5X,30H INSTRUMENTS
     9     =,F11.2,/,5X,30H HYDRAULICS                   =,F11.2,/,5X,30H
     $ ELECTRICAL                   =,F11.2,/,5X,30H AVIONICS
     $          =,F11.2,/,5X,30H FURNISHINGS                 =,F11.2,/,5X,
     $30H AIR AND ICE                  =,F11.2,/,5X,30H LOAD AND HANDLING
     $              =,F11.2,///,5X,30H TOTAL COST PER VEHICLE      =,F11.2)
2820  FORMAT (33H ENTER THE INFLATION RATE DOLLARS)
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2830  FORMAT (/27H        DYNAMIC PARAMETERS,/,38H     A11.............
     1.................,F10.6/,38H      A12.............................
     2,F10.6/,38H     A13..............................,F10.6/,38H      A
     314..............................,F10.6/,38H      T1..............
     4................,F10.6/,38H      T2................................,F
     510.6/,38H     T3..............................,F10.6/,38H      T4.
     6..............................,F10.6/,38H      INFLOW RATIO (LAMBDA
     7).............,F10.6)
2840  FORMAT (/,5X,37HINBOARD STALL CORRECTION FACTOR.......,F16.7//,5X,3
     17HSTALL POWER COEFFICIENT...............,F14.7)
2850  FORMAT (/,5X,28HANGLE OF ATTACK CALCULATIONS//,5X,35HLONGITUDINAL
     1CYCLIC ANGLE(DEG).....,F10.6/,5X,35HLONGITUDINAL COLLECTIVE ANGLE(
     2DEG)..,F10.6/,5X,35HALPHA(90) (DEG)...................,F10.6/,5X,3
     35HALPHA(270) (DEG)....................,F10.6)
2860  FORMAT (/10X,24HSTALL POWER CALCULATIONS//,5X,35HRT..............
     1..................,F12.6)
2870  FORMAT (/10X,23HHIGH SPEED MACH EFFECTS//,5X,34HADVANCING BLADE TI
     1P MACH NUMBER...,F12.6/,5X,34HCRITICAL MACH NUMBER..............,F
     212.6/,5X,34HDRAG DIVERGENCE MACH NUMBER.......,F12.6/,5X,35HCOMPRE
     3SSIBILITY PCWER COEFF........,F12.6///,58H     *********************
     4*************************************/,/33H        MAIN ROTOR POWER R
     5EQUIRED/,58H     ***************************************************
     6****//,22H      INDUCED POWER = ,6X,F12.2/,22H      PROFILE POWER
     7= ,6X,F12.2/,23H      PARASITE POWER = ,5X,F12.2/,29H      COMPRES
     8IBILITY POWER = ,F12.2/,20H      STALL POWER = ,9X,F12.2//,27H
     9  HIGH SPEEC EFFECTS = ,F12.2/)
2880  FORMAT (54H1     **************************************************/
     1,10X,31HFORWARD VELOCITY IN KNOTS    =  ,F7.2/,54H      ************
     2***************************************)
2890  FORMAT (/5X,44HTIP MACH NUMBER GREATER THAN OR EQUAL TO 1.0/)
2900  FORMAT (/5X,29HDISK PLANE ANGLE OF ATTACK = ,F10.6/)
2910  FORMAT (38H     COEFFICIENT OF THRUST............ ,F12.6/,38H     DI
     1SC AREA........................ ,F12.6/,38H     SOLIDITY...........
     2.............. ,F12.6/,38H     TIP-LOSS FACTCR.................. ,F
     312.6/,38H     GROUND EFFECT RATIO.............. ,F12.6//)
2920  FORMAT (38H1     RADIUS.......................... ,F12.6/,38H     MA
     1IN ROTOR CHCRD................ ,F12.6/,38H     NUMBER OF MAIN ROTO
     2R BLADES...... ,F12.6/,38H     AICRAFT GROSS WEIGHT............ ,F
     312.6/,38H     ROTOR TIP VELOCITY............... ,F12.6/,38H     HORI
     4ZONTAL FLAT PLATE AREA....... ,F12.6/,38H     NUMBER OF ENGINES IN
     5HELICOPTER.. ,F12.6//,38H     MAIN ROTOR HEIGHT ABOVE GROUND... ,F1
     62.6/,35H     AIR DENSITY (RHO)............ ,F12.6/,38H     SONIC VE
     7LOCITY.................. ,F12.6/,38H     BLADE GEOMETRIC TWIST....
     8........ ,F12.6//,38H     MAXIMUM 2-D LIFT CCEFFICIENT..... ,F12.6/
     9,38H     2-D STATIC STALL ANGLE (AMAX).... ,F12.7/,38H     LIFT CURV
     $E SLOPE (/RAD).......... ,F12.6/,35H     ZERO-LIFT DRAG COEEFICIENT
     $.....,F12.6/,35H     CRITICAL MACH NC (FOR CL = 0)..,F12.6)
2930  FORMAT (///48H ENTER THE VALUE OF THE CRITICAL MACH NUMBER AT ,/,2
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     1IH ZERC ANGLE OF ATTACK)
2940  FORMAT (51H ENTER THE VALUE OF THE MAXIMUM COEFFICIENT OF LIFT,/,2
     16H FOR YOUR SELECTED AIRFOIL)
2950  FORMAT (53H ENTER THE VALUE OF THE VELCCITY WHERE THE RETREATING,/
     1,42H BLADE STALL ANGLE IS NEAREST 12.5 DEGREES)
2960  FORMAT (///42H ENTER THE SPAN OF THE VERTICAL STABILIZER)
2970  FORMAT (29H THE TAIL ROTOR SOLIDITY IS  ,F9.7,//,35H ENTER THE VER
     1TICAL STABILIZER AREA)
2980  FORMAT (////36H          VERTICAL STABILIZER DATA ,//,40X,23H   8
     10 KNOTS   160 KNOTS,/,37H SECTION COEFFICIENT OF LIFT        ,5X,
     2F8.5,5X,F8.5,/,37H ANGLE OF ATTACK TO UNLOAD TAIL ROTOR,6X,F6.3,7X
     3,F6.3)
      END
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D. SAMPLE OUTPUT

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GROSS WEIGHT (LBS)                =  14400.00
EMPTY WEIGHT (LBS)                =   4320.00
SONIC SPEED (FPS)                 =   1116.89
MAXIMUM TIP VELOCITY (FPS)        =    725.98
DISK LOADING                      =      7.10
ROTOR RADIUS (FT)                 =     25.41
ROTATIONAL VELOCITY (RPS)         =     28.57
TIP VELOCITY (FPS)                =    725.98
COEFFICIENT CF THRUST             =      0.005668
ADVANCE RATIC (MU)                =      0.3721
BLADE LOADING                     =      0.0960
SOLIDITY                          =      0.0590377
NUMBER OF MAIN RCTOR BLADES       =      4
CHORD MAIN RCTOR BLADE (FT)       =      1.178138
             THE ASPECT RATIO IS     =        21.567
             THE ROTATIONAL SPEED IS=         28.572
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GROSS WEIGHT (LBS)                =  14400.00
EMPTY WEIGHT (LBS)                =   4320.00
SONIC SPEED (FPS)                 =   1116.89
MAXIMUM TIP VELOCITY (FPS)        =    725.98
DISK LOADING (LBS/SF)             =      7.10
ROTOR RADIUS (FT)                 =     25.41
ROTATIONAL VELOCITY (RPS)         =     27.00
TIP VELOCITY (FPS)                =    686.03
COEFFICIENT OF THRUST             =      0.006347
ADVANCE RATIC (MU)                =      0.3937
BLADE LOADING                     =      0.0920
SOLIDITY                          =      0.0689887
NUMBER OF MAIN RCTOR BLADES       =      4
CHORD MAIN ROTOR BLADE (FT)       =      1.377
ASPECT RATIO OF MAIN ROTOR        =     18.46
COEFF OF LIFT (AVG)               =      0.5520
COEFF OF LIFT W/R ALPHA           =      6.3025
COEFF OF DRAG @ 0 LIFT            =      0.0100
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TIP LOSS FACTCR                         =        0.9721020
POWER (INDUCED)(HP)                     =     1310.3
POWER (PROFILE)(HP)                     =      353.6
POWER (TOTAL)(HP)                       =     1663.9
EMPTY WEIGHT (LBS)                      =     8867.39
FUEL WEIGHT (LBS)                       =     4000.00
NUMBER OF PECPLE                        =       14
USEFUL LOAD (LBS)                       =     4500.00
NUMBER OF ENGINES                       =        2
ESTIMATED GROSS WEIGHT(LBS)             =    17367.39
SOLIDITY                                =        0.0762025
ROTOR RADIUS (FT)                       =       26.734
HOVER POWER (HP)                        =     1663.9
ROTOR WEIGHT(LBS)                       =     1725.18
TAIL: ROTOR (LBS)                       =       88.54
      STRUCTURE (LBS)                   =      111.77
BODY (LBS)                              =     1323.89
LANDING GEAR (LBS)                      =      624.21
NACELLE (LBS)                           =      178.53
PROPULSION: ENGINE (LBS)                =     1215.64
            CRIVE (LBS)                 =      957.32
            FUEL TANKS (LBS)            =      676.30
FLIGHT CONTRCLS (LBS)                   =      587.49
AUXILLARY POWER (LBS)                   =      190.00
INSTRUMENTS (LBS)                       =      103.83
HYDRAULICS (LBS)                        =       74.42
ELECTRICAL (LBS)                        =      407.26
AVIONICS (LBS)                          =      309.11
FURNISHINGS (LBS)                       =      432.75
AIR AND ICE (LBS)                       =       83.72
LOAD AND HANCLING (LBS)                 =       84.50

REVISED EMPTY WEIGHT (LBS)              =     9174.45
REVISED GROSS WEIGHT (LBS)              =    17674.45


FIGURE OF MERIT (%)                     = 78.747
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MAIN ROTOR POWER PROFILE
@ SSL

AIRSPEED (KNCTS)	TIP MACH	POWER: INDUCED (SHP)	POWER: PROFILE (SHP)	POWER: PARASITE (SHP)	POWER: TOTAL (SHP)
0.0	0.65	1335.01	353.65	0.0	1688.66
5.00	0.66	1320.66	353.85	0.04	1674.55
10.00	0.67	1278.58	354.47	0.30	1633.35
15.00	0.67	1211.97	355.50	1.03	1568.49
20.00	0.68	1126.64	356.94	2.44	1486.02
25.00	0.69	1030.82	358.78	4.76	1394.36
30.00	0.70	933.41	361.05	8.23	1302.68
35.00	0.70	841.59	363.72	13.06	1218.37
40.00	0.71	759.33	366.80	19.50	1145.63
45.00	0.72	687.74	370.30	27.76	1085.80
50.00	0.73	626.25	374.20	38.08	1038.53
55.00	0.73	573.59	378.52	50.69	1002.80
60.00	0.74	528.38	383.25	65.81	977.44
65.00	0.75	489.36	388.39	83.67	961.41
70.00	0.76	455.44	393.94	104.50	953.88
75.00	0.76	425.77	399.90	128.53	954.20
80.00	0.77	399.62	406.27	155.99	961.89
85.00	0.78	376.44	413.05	187.11	976.60
90.00	0.79	355.76	420.25	222.10	998.11
95.00	0.79	337.20	427.85	261.22	1026.27
100.00	0.80	320.46	435.87	304.67	1061.00
105.00	0.81	305.29	444.30	352.69	1102.28
110.00	0.82	291.48	453.14	405.52	1150.13
115.00	0.82	278.86	462.39	463.37	1204.61
120.00	0.83	267.28	472.05	526.47	1265.80
125.00	0.84	256.61	482.12	595.06	1333.80
130.00	0.85	246.77	492.61	669.36	1408.74
135.00	0.85	237.65	503.50	749.60	1490.76
140.00	0.86	229.16	514.81	836.02	1579.98
145.00	0.87	221.31	526.52	928.83	1676.66
150.00	0.88	213.94	538.65	1028.26	1780.85
155.00	0.88	207.03	551.19	1134.55	1892.77
160.00	0.89	200.55	564.14	1247.93	2012.63
165.00	0.90	194.49	577.50	1368.62	2140.61
170.00	0.91	188.75	591.28	1496.84	2276.87
175.00	0.91	183.41	605.46	1632.84	2421.71
180.00	0.92	178.30	620.05	1776.84	2575.19
185.00	0.93	173.43	635.06	1929.06	2737.55
190.00	0.94	168.90	650.48	2089.73	2909.11

MAIN ROTOR POWER PROFILE
AT SPECIFICATION ALTITUDE AND TEMPERATURE

AIRSPEED (KNCTS)	TIP MACH	POWER INDUCED (SHP)	POWER PROFILE (SHP)	POWER PARASITE (SHP)	POWER TOTAL (SHP)
0.0	0.63	1388.74	326.81	0.0	1715.55
5.00	0.64	1374.93	327.00	0.04	1701.97
10.00	0.64	1334.39	327.57	0.28	1662.24
15.00	0.65	1269.92	328.52	0.95	1599.40
20.00	0.66	1186.67	329.85	2.25	1518.77
25.00	0.67	1091.99	331.56	4.40	1427.95
30.00	0.67	994.20	333.65	7.60	1335.45
35.00	0.68	900.45	336.12	12.07	1248.65
40.00	0.69	815.19	338.97	18.02	1172.18
45.00	0.69	740.10	342.20	25.66	1107.95
50.00	0.70	675.03	345.81	35.19	1056.03
55.00	0.71	618.95	349.80	46.84	1015.60
60.00	0.72	570.60	354.17	60.82	985.58
65.00	0.72	528.74	358.92	77.32	964.97
70.00	0.73	492.27	364.05	96.57	952.89
75.00	0.74	460.33	369.55	118.78	948.66
80.00	0.75	432.14	375.44	144.16	951.74
85.00	0.75	407.13	381.71	172.91	961.75
90.00	0.76	384.80	388.36	205.25	978.42
95.00	0.77	364.76	395.39	241.40	1001.54
100.00	0.78	346.67	402.80	281.55	1031.02
105.00	0.78	330.28	410.59	325.93	1066.80
110.00	0.79	315.35	418.76	374.75	1108.85
115.00	0.80	301.71	427.30	428.21	1157.22
120.00	0.80	289.18	436.23	486.52	1211.94
125.00	0.81	277.65	445.54	549.91	1273.10
130.00	0.82	267.01	455.23	618.57	1340.81
135.00	0.83	257.14	465.30	692.73	1415.17
140.00	0.83	247.98	475.75	772.58	1496.31
145.00	0.84	239.43	486.57	858.35	1584.35
150.00	0.85	231.49	497.78	950.24	1679.52
155.00	0.86	224.00	509.37	1048.47	1781.83
160.00	0.86	217.06	521.34	1153.24	1891.64
165.00	0.87	210.45	533.68	1264.77	2008.90
170.00	0.88	204.28	546.41	1383.27	2133.96
175.00	0.88	198.43	559.52	1508.95	2266.90
180.00	0.89	192.94	573.01	1642.02	2407.96
185.00	0.90	187.68	586.87	1782.69	2557.25
190.00	0.91	182.76	601.12	1931.17	2715.05

TAIL ROTOR RADIUS (FT)= 5.451
TAIL ROTOR SPEED (RPS)= 122.201
TAIL ROTOR CDO = 0.0138000

TAIL ROTOR POWER PROFILE
@ SSL

AIRSPEED	TIP	POWER INDUCED	PROFILE	TOTAL
(KNOTS)	MACH	(SHP)	(SHP)	(SHP)
0.0	0.60	95.87	43.67	139.54
5.00	0.60	93.94	43.70	137.63
10.00	0.61	88.34	43.79	132.13
15.00	0.62	79.67	43.94	123.61
20.00	0.63	68.94	44.15	113.09
25.00	0.63	57.45	44.42	101.87
30.00	0.64	46.56	44.75	91.31
35.00	0.65	37.26	45.14	82.40
40.00	0.66	29.91	45.60	75.50
45.00	0.66	24.37	46.11	70.48
50.00	0.67	20.29	46.68	66.97
55.00	0.68	17.31	47.31	64.62
60.00	0.69	15.13	48.01	63.14
65.00	0.69	13.54	48.76	62.30
70.00	0.70	12.40	49.57	61.97
75.00	0.71	11.59	50.45	62.04
80.00	0.72	11.05	51.38	62.43
85.00	0.72	10.73	52.38	63.11
90.00	0.73	10.59	53.43	64.02
95.00	0.74	10.62	54.55	65.16
100.00	0.75	10.79	55.72	66.51
105.00	0.76	11.10	56.96	68.06
110.00	0.76	11.54	58.26	69.80
115.00	0.77	12.12	59.61	71.73
120.00	0.78	12.83	61.03	73.86
125.00	0.79	13.69	62.51	76.20
130.00	0.79	14.70	64.04	78.74
135.00	0.80	15.87	65.64	81.51
140.00	0.81	17.21	67.30	84.51
145.00	0.82	18.73	69.02	87.75
150.00	0.82	20.45	70.80	91.25
155.00	0.83	22.38	72.63	95.02
160.00	0.84	24.55	74.53	99.08
165.00	0.85	26.96	76.49	103.46
170.00	0.85	29.65	78.51	108.16
175.00	0.86	32.63	80.59	113.22
180.00	0.87	35.92	82.73	118.65
185.00	0.88	39.55	84.93	124.48
190.00	0.88	43.55	87.19	130.75

TAIL ROTOR POWER PROFILE
AT SPECIFICATION ALTITUDE AND TEMPERATURE

AIRSPEED (KNCTS)	TIP MACH	POWER INDUCED (SHP)	POWER PROFILE (SHP)	POWER TOTAL (SHP)
0.0	0.58	102.31	40.35	142.66
5.00	0.58	100.38	40.38	140.76
10.00	0.59	94.79	40.46	135.25
15.00	0.60	86.08	40.60	126.69
20.00	0.61	75.18	40.80	115.98
25.00	0.61	63.33	41.05	104.38
30.00	0.62	51.83	41.36	93.19
35.00	0.63	41.76	41.72	83.48
40.00	0.64	33.60	42.14	75.73
45.00	0.64	27.33	42.61	69.94
50.00	0.65	22.65	43.14	65.79
55.00	0.66	19.19	43.72	62.91
60.00	0.66	16.64	44.36	61.00
65.00	0.67	14.76	45.06	59.82
70.00	0.68	13.39	45.81	59.20
75.00	0.69	12.40	46.62	59.C2
80.00	0.69	11.71	47.48	59.20
85.00	0.70	11.27	48.40	59.67
90.00	0.71	11.02	49.38	60.40
95.00	0.72	10.95	50.41	61.36
100.00	0.72	11.03	51.50	62.52
1C5.00	0.73	11.25	52.64	63.89
110.00	0.74	11.61	53.84	65.45
115.00	0.75	12.11	55.09	67.20
120.00	0.75	12.74	56.40	69.14
125.00	0.76	13.51	57.76	71.27
130.00	0.77	14.42	59.18	73.60
135.00	0.77	15.48	60.66	76.14
140.00	0.78	16.71	62.19	78.90
145.00	0.79	18.11	63.78	81.89
150.00	0.80	19.69	65.42	85.11
155.00	0.80	21.47	67.12	88.60
160.00	0.81	23.47	68.88	92.35
165.00	0.82	25.70	70.69	96.39
170.00	0.83	28.19	72.55	100.74
175.00	0.83	30.94	74.48	105.42
180.00	0.84	33.99	76.45	110.45
185.00	0.85	37.36	78.49	115.84
190.00	0.85	41.06	80.58	121.64

VERTICAL STABILIZER DATA

	80 KNOTS	160 KNOTS
SECTION COEFFICIENT OF LIFT	0.83326	0.46359
ANGLE OF ATTACK TO UNLOAD TAIL ROTOR	22.263	3.268

RADIUS...........................	26.733826
MAIN ROTOR CHCRD..................	1.600000
NUMBER OF MAIN ROTOR BLADES.......	0.000000
AICRAFT GRCSS WEIGHT..............	17585.0703
ROTOR TIP VELCCITY................	725.978027
HORIZONTAL FLAT PLATE AREA........	29.308441
NUMBER OF ENGINES IN HELICOPTER..	0.000000
MAIN ROTOR HEIGHT ABOVE GROUND...	23.000000
AIR DENSITY (RHO).............	0.002197
SONIC VELCCITY....................	1154.32056
BLADE GECMETRIC TWIST.............	-0.174533
MAXIMUM 2-D LIFT COEFFICIENT......	1.250000
2-D STATIC STALL ANGLE (AMAX)....	0.1983330
LIFT CURVE SLCPE (/RAD)...........	6.302530
ZERO-LIFT CRAG COEFFICIENT.....	0.010000
CRITICAL MACH NO (FOR CL = 0)..	0.720000
COEFFICIENT OF THRUST.............	0.006765
DISC AREA.........................	2245.28784
SOLIDITY..........................	0.076202
TIP-LOSS FACTCR...................	0.970920
GROUND EFFECT RATIO...............	0.874897

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*************************************************
     FORWARD VELOCITY IN KNOTS    =      0.0
*************************************************
DISK PLANE ANGLE OF ATTACK =   0.0

    DYNAMIC PARAMETERS
A11...............................  0.0
A12...............................  0.0
A13...............................  0.0
A14...............................  1.000000
T1................................  0.471343
T2................................  0.305091
T3................................  0.222164
T4................................  0.0
INFLOW RATIO (LAMBDA)............ -0.058160

     STALL POWER CALCULATIONS
RT...............................     -0.028292

INBOARD STALL CORRECTION FACTOR......       0.0
STALL POWER COEFFICIENT.............     0.0

ANGLE OF ATTACK CALCULATIONS
LONGITUDINAL CYCLIC ANGLE(DEG).....  0.0
LONGITUDINAL COLLECTIVE ANGLE(DEG). 17.720932
ALPHA(90) (DEG)....................  4.388375
ALPHA(270) (DEG)...................  4.388375

     HIGH SPEED MACH EFFECTS

ADVANCING BLADE TIP MACH NUMBER...    0.628922
CRITICAL MACH NUMBER..............    0.665450
DRAG DIVERGENCE MACH NUMBER.......    0.0
COMPRESSIBILITY POWER COEFF........    0.0


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   MAIN ROTOR POWER REQUIRED
*************************************************

 INDUCED POWER =            1388.74
 PROFILE POWER =             326.81
 PARASITE POWER =              0.0
 COMPRESIBILITY POWER =        0.0
 STALL POWER =                 0.0

 HIGH SPEED EFFECTS =        0.0
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*****************************************************
    FORWARD VELOCITY IN KNOTS   =   140.00
*****************************************************

    DYNAMIC PARAMETERS
A11..............................  0.711244
A12..............................  0.947375
A13..............................  0.689869
A14..............................  1.238236
T1...............................  0.497838
T2...............................  0.356539
T3...............................  0.247140
T4...............................  0.157756
INFLOW RATIO (LAMBDA)............ -0.053642

     STALL PCWER CALCULATIONS

RT.................................     0.002215
INBOARD STALL CORRECTION FACTOR.......       0.5647528
STALL PCWER COEFFICIENT...............     0.0000402

ANGLE OF ATTACK CALCULATIONS

LONGITUDINAL CYCLIC ANGLE(DEG)..... -7.126393
LONGITUDINAL COLLECTIVE ANGLE(DEG). 18.903610
ALPHA(90) (DEG).................... -0.541373
ALPHA(270) (CEG)................... 13.710670

     HIGH SPEED MACH EFFECTS

ADVANCING BLADE TIP MACH NUMBER...     0.833665
CRITICAL MACH NUMBER..............     0.726730
DRAG DIVERGENCE MACH NUMBER.......     0.046935
COMPRESSIBILITY POWER COEFF........     0.000044

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    MAIN ROTOR POWER REQUIRED
************************************************************

  INDUCED POWER =               247.98
  PROFILE POWER =               475.75
  PARASITE POWER =              772.58
  COMPRESIBILITY POWER =         149.96
  STALL PCWER =                  137.91

  HIGH SPEED EFFECTS =        287.86
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NOTE THE VELCCITY THAT HAS THE STALL ANGLE LESS
THAN OR EQUAL TO 12.5 DEGREES

VELOCITY (KNOTS)	ANGLE (DEG)
126.94	12.1
127.94	12.2
128.94	12.3
129.94	12.4
130.94	12.6
131.94	12.7
132.94	12.8
133.94	12.9

TOTAL POWER FOR THE AIRCRAFT TO HOVER IS= 1829.48

TOTAL ROTOR POWER PROFILE
@ SSL

AIRSPEED (KNOTS)	INDUCED (SHP)	PROFILE (SHP)	PARASITE (SHP)	COMP (SHP)	TOTAL (SHP)
	POWER				
0.0	1430.88	397.31	0.0	0.0	1828.19
5.00	1414.59	397.55	0.04	0.0	1812.18
10.00	1366.92	398.26	0.30	0.0	1765.48
15.00	1291.64	399.43	1.03	0.0	1692.10
20.00	1195.58	401.08	2.44	0.0	1599.10
25.00	1088.26	403.20	4.76	0.0	1496.23
30.00	979.97	405.80	8.23	0.0	1393.99
35.00	878.84	408.86	13.06	0.0	1300.77
40.00	789.23	412.40	19.50	0.0	1221.13
45.00	712.11	416.40	27.76	0.0	1156.27
50.00	646.54	420.88	38.08	0.0	1105.50
55.00	590.90	425.83	50.69	0.0	1067.42
60.00	543.51	431.25	65.81	0.0	1040.57
65.00	502.90	437.15	83.67	0.0	1023.71
70.00	467.84	443.51	104.50	0.0	1015.85
75.00	437.36	450.35	128.53	0.0	1016.24
80.00	410.68	457.65	155.99	0.0	1024.32
85.00	387.17	465.43	187.11	0.0	1039.71
90.00	366.35	473.68	222.10	0.0	1062.13
95.00	347.81	482.40	261.22	0.0	1091.43
100.00	331.24	491.59	304.67	0.0	1127.51
105.00	316.38	501.26	352.69	11.43	1181.76
110.00	303.02	511.39	405.52	31.39	1251.32
115.00	290.97	522.00	463.37	51.64	1327.98
120.00	280.11	533.08	526.47	72.18	1411.85
125.00	270.31	544.63	595.06	93.04	1503.04
130.00	261.47	556.65	669.36	114.24	1601.73
135.00	253.52	569.14	749.60	135.80	1708.07
140.00	246.37	582.11	836.02	157.74	1822.23
145.00	240.04	595.54	928.83	180.09	1944.50
150.00	234.39	609.45	1028.26	300.73	2172.83
155.00	229.41	623.83	1134.55	410.13	2397.91
160.00	225.10	638.67	1247.93	450.93	2562.63
165.00	221.46	653.99	1368.62	479.91	2723.98
170.00	218.39	669.79	1496.84	502.78	2887.80
175.00	216.04	686.05	1632.84	522.22	3057.15
180.00	214.22	702.79	1776.84	539.78	3233.62
185.00	212.98	719.99	1929.06	556.41	3418.44
190.00	212.45	737.67	2089.73	572.74	3612.59

TOTAL ROTOR POWER PROFILE
AT SPECIFICATION ALTITUDE AND TEMPERATURE

AIRSPEED (KNOTS)	INDUCED (SHP)	PROFILE (SHP)	PARASITE (SHP)	COMP (SHP)	TOTAL (SHP)
	POWER				
0.0	1491.04	367.17	0.0	0.0	1858.21
5.00	1475.31	367.38	0.04	0.0	1842.73
10.00	1429.18	368.04	0.28	0.0	1797.50
15.00	1356.00	369.13	0.95	0.0	1726.08
20.00	1261.85	370.65	2.25	0.0	1634.75
25.00	1155.31	372.61	4.40	0.0	1532.32
30.00	1046.03	375.01	7.60	0.0	1428.64
35.00	942.21	377.84	12.07	0.0	1332.12
40.00	848.79	381.11	18.02	0.0	1247.91
45.00	767.43	384.81	25.66	0.0	1177.89
50.00	697.67	388.95	35.19	0.0	1121.81
55.00	638.14	393.52	46.84	0.0	1078.51
60.00	587.24	398.53	60.82	0.0	1046.59
65.00	543.50	403.98	77.32	0.0	1024.80
70.00	505.67	409.86	96.57	0.0	1012.10
75.00	472.73	416.18	118.78	0.0	1007.68
80.00	443.86	422.93	144.16	0.0	1010.94
85.00	418.40	430.12	172.91	0.0	1021.42
90.00	395.82	437.74	205.25	0.0	1038.81
95.00	375.70	445.80	241.40	0.0	1062.90
100.00	357.70	454.29	281.55	0.49	1094.04
105.00	341.53	463.22	325.93	18.14	1148.82
110.00	326.96	472.59	374.75	36.06	1210.36
115.00	313.81	482.39	428.21	54.26	1278.67
120.00	301.92	492.63	486.52	72.75	1353.82
125.00	291.16	503.30	549.91	91.55	1435.92
130.00	281.43	514.41	618.57	110.67	1525.08
135.00	272.62	525.96	692.73	130.13	1621.44
140.00	264.69	537.94	772.58	287.86	1863.07
145.00	257.53	550.35	858.35	380.57	2046.80
150.00	251.18	563.20	950.24	458.59	2223.22
155.00	245.47	576.49	1048.47	484.69	2355.12
160.00	240.53	590.21	1153.24	498.32	2482.30
165.00	236.15	604.37	1264.77	509.39	2614.69
170.00	232.46	618.97	1383.27	519.13	2753.83
175.00	229.37	634.00	1508.95	528.34	2900.66
180.00	226.93	649.46	1642.02	537.54	3055.96
185.00	225.04	665.36	1782.69	547.12	3220.21
190.00	223.82	681.70	1931.17	557.34	3394.03

THE REQUIRED SHAFT HCRSEPOWER IS = 3013.56

FOR 2 ENGINE(S), THE REQUIRED SHAFT HORSEPOWER IS= 3415.32

ENGINE SELECTION CRITERIA

------------- 1 ENGINE -----------------

	A	B	C	D	E	F
POWERPLANT WEIGHT(LB):	158.0	288.0	423.0	709.0	580.0	750.0
LIFE-CYCLE CCST($10M):	3.00	5.97	10.95	14.50	18.13	25.39
ENGINE LIFE(HRS):	600.0	750.0	800.0	800.0	1000.0	750.0
NUMBER OF REFLACEMENT:	4.0	3.0	3.0	3.0	2.0	3.0
R AND D COSTS($K):	0.0	0.0	0.0	0.0	0.0	0.0
INTIAL COSTS($K):	93.0	100.0	580.0	360.0	640.0	700.0
YEAR MAINT COST($K):	7.50	15.00	30.00	37.50	48.00	66.00
YEAR OPERATE COST($K):	2.40	4.80	6.00	10.50	12.00	18.00
REPLACEMENT CCST($K):	125.55	135.00	783.00	486.00	864.00	945.00
SALVAGE VALUE($K):	74.40	80.00	464.00	288.00	512.00	560.00
AVAILABILITY(ENG):	0.8333	0.8333	0.8000	0.6977	0.6667	0.5738
RELIABILITY(ENG):	0.9892	0.9905	0.9903	0.9930	0.9929	0.9938
MAINTAINABILITY(ENG):	0.350	0.300	0.250	0.650	1.000	1.300
PERFORMANCE(SHP-MIL):	420.0	708.0	1561.0	1800.0	2500.0	3400.0

ENGINE SELECTION CRITERIA

--------- 2 ENGINE(S) -------------

	A	B	C	D	E	F
POWERPLANT WEIGHT(LB):	316.0	576.0	846.0	1418.0	1160.0	1500.0
LIFE-CYCLE COST($10M):	6.00	11.93	21.91	28.99	36.27	50.77
ENGINE LIFE(HRS):	600.0	750.0	800.0	800.0	1000.0	750.0
NUMBER OF REPLACEMENT:	8.0	6.0	5.0	5.0	4.0	6.0
R AND D COSTS($K):	0.0	0.0	0.0	0.0	0.0	0.0
INTIAL COSTS($K):	186.0	200.0	1160.0	720.0	1280.0	1400.0
YEAR MAINT CCST($K):	15.00	30.00	60.00	75.00	96.00	132.00
YEAR OPERATE COST($K):	4.80	9.60	12.00	21.00	24.00	36.00
REPLACEMENT COST($K):	251.10	270.00	1566.00	972.00	1728.00	1890.00
SALVAGE VALUE($K):	148.80	160.00	928.00	576.00	1024.00	1120.00
AVAILABILITY(ENG):	0.8333	0.8333	0.8000	0.6977	0.6667	0.5738
RELIABILITY(ENG):	0.9892	0.9905	0.9903	0.9930	0.9929	0.9938
MAINTAINABILITY(ENG):	0.350	0.300	0.250	0.650	1.000	1.300
PERFORMANCE(SHP-MIL):	840.0	1416.0	3122.0	3600.0	5000.0	6800.0

THE REQUIREC SHAFT HCRSEPOWER IS = 3415.32

OLD GROSS WEIGHT = 17585.07
NEW GROSS WEIGHT = 18409.23

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------------------FUEL FLOW RATES---------------
 MILITARY POWER      NORMAL POWER      CRUISE POWER
    2142.00            1854.36            1517.66



TEMPERATURE (R)                   =    504.423
PRESSURE (PSF)                    =   1827.697
ALPHA AT SSL                      =    624.344
THETA AT SPEC ALTITUDE            =      0.972
DELTA AT SPEC ALTITUDE            =      0.864
ZERC HORSEPCWER INTERCEPT
AT SPEC ALTITUDE                  =    531.755


THE ZERO HORSEPOWER INCREMENT AT ALTITUDE=  2221.240


THE FUEL WEIGHT IS   =   3959.12LBS
THE DESIGN GROSS WEIGHT IS    =  18368.34
THE ESTIMATED GRCSS WEIGHT IS =  17585.07


THE BEST RATE OF CLIMB IS   3800.00 FEET PER MINUTE


THE HOVER CEILING ALTITUDE IS =  12000.00


THE SERVICE CEILING ALTITUDE IS =  21000.00
```

HELICOPTER DESIGN
AE4306
FINAL SUMMARY

PERFORMANCE

	SPECIFICATION	DESIGN
CREW	3	14
INTERNAL LOAD(LBS)	3750.0	4500.0
SERVICE CEILING(FT)	17500.0	21000.0
HOVER IGE (FT)	12000.0	12000.0
VELOCITY (KTS) CRUISE	135.0	170.0
MAXIMUM	160.0	196.0
MAX ENDURANCE		70.0
MAX RANGE		170.0
RETREATING BLADE STALL		130.0
MAXIMUM RANGE (NMI)	250.0	250.0
MAXIMUM RATE OF CLIMB (FT/MIN)	2500.0	3800.0
ENGINE - NUMBER		2
TYPE		D
SHP (SSL) MILITARY		3600.0

GEOMETRY

	SPECIFICATION	DESIGN
WEIGHT (LBS) - MAX GROSS	18000.0	18368.3
EMPTY		9095.5
FUEL CAPACITY (GAL) -INTERNAL		609.1
EXTERNAL		0.0
MAIN ROTOR - CHORD (FT)		1.60
RADIUS (FT)	29.00	26.73
NUMBER OF BLADES		4
DRAG COEFFICIENT		0.0100
ROTATIONAL VELOCITY		27.16
SOLIDITY		0.076202
TAIL ROTOR - CHORD (FT)		0.91
RADIUS (FT)		5.45
NUMBER BLADES		4
DRAG COEFFICIENT		0.0138
ROTATIONAL VELOCITY		122.20
SOLIDITY		0.212207
VERTICAL TAIL AREA (FT)		55.43
FUSELAGE LENGTH (FT)	56.00	50.10
EQUIVALENT FLAT PLAGE AREA (FT) FORWARD		29.31
VERTICAL		58.62

COST ANALYSIS PER VEHICLE (IN DOLLARS FOR 100 A/C RUN)

```
ROTOR                          =   207647.31
TAIL:  RCTOR                   =    11561.87
       STRUCTURE               =    20104.41
BODY                           =   182568.06
LANDING GEAR                   =   119506.94
NACELLE                        =    34988.90
PROPULSION:  ENGINE            =  1281599.00
             DRIVE             =   121739.87
             FUEL TANKS        =   160159.44
FLIGHT CCNTROLS                =   109443.50
AUXILLARY PCWER                =    54397.60
INSTRUMENTS                    =    15419.93
HYDRAULICS                     =     8067.89
ELECTRICAL                     =    68819.69
AVIONICS                       =    52901.66
FURNISHINGS                    =    35208.07
AIR ANC ICE                    =    21086.03
LOAD ANC HANDLING              =    20675.80

TOTAL CCST FER VEHICLE         =  2525889.00
```

APPENDIX C

TABLE III

AH-64 Data

Parameter	Value	
Main rotor radius	24.0	feet
Tail rotor radius	4.6	feet
Number of main rotor blades	4	
Number of tail rotor blades	4	
Height of the main rotor system	12.6	feet
Speed of the main rotor	30.3	rads/sec
Speed of the tail rotor	147.0	rads/sec
Chord of the main rotor	1.75	feet
Chord of the tail rotor	0.83	feet
Span of the main rotor	18.8	feet
Span of the tail rotor	3.1	feet
Twist of the main rotor blade	-9.0	degrees
Twist of the tail rotor blade	-8.8	degrees
Profile drag of the main rotor blade	0.009	
Profile drag of the tail rotor blade	0.009	
Disc loading of the main rotor system	8.1	
Width of the fuselage	3.96	feet
Length of the fuselage	49.1	feet
Frontal equivalent flat plate area	34.7	sq ft
Vertical equivalent flat plate area	45.8	sq ft
Maximum forward velocity	154	knots
Maximum range	246	nmi
Rate of climb	2490	ft/min
Hover ceiling (IGE)	14,200	feet
Hover ceiling (OGE)	11,000	feet
Length of the tail	29.7	feet
Operating weight	11,010	pounds
Load weight	2,020	pounds
Fuel weight	1,620	pounds
Maximum gross weight	14,650	pounds

TABLE IV

OH-6A Data

Parameter	Value	
Main rotor radius	16.3	feet
Tail rotor radius	4.3	feet
Number of main rotor blades	4	
Number of tail rotor blades	2	
Height of the main rotor system	7.0	feet
Speed of the main rotor	49.2	rads/sec
Speed of the tail rotor	315.0	rads/sec
Chord of the main rotor	0.57	feet
Chord of the tail rotor	0.40	feet
Span of the main rotor	11.5	feet
Span of the tail rotor	1.4	feet
Twist of the main rotor blade	-9.0	degrees
Twist of the tail rotor blade	-8.0	degrees
Profile drag of the main rotor blade	0.009	
Profile drag of the tail rotor blade	0.009	
Disc loading of the main rotor system	8.1	
Width of the fuselage	4.57	feet
Length of the fuselage	23.0	feet
Frontal equivalent flat plate area	5.0	sq ft
Vertical equivalent flat plate area	10.8	sq ft
Maximum forward velocity	116	knots
Maximum range	330	nmi
Rate of climb	500	ft/min
Hover ceiling (IGE)	7,100	feet
Hover ceiling (OGE)	4,200	feet
Length of the tail .	15.2	feet
Operating weight	1,160	pounds
Load weight	960	pounds
Fuel weight	400	pounds
Maximum gross weight	2,520	pounds

TABLE V

SH-3H Data

Parameter	Value	
Main rotor radius	31.0	feet
Tail rotor radius	5.3	feet
Number of main rotor blades	5	
Number of tail rotor blades	5	
Height of the main rotor system	14.3	feet
Speed of the main rotor	21.3	rads/sec
Speed of the tail rotor	130.0	rads/sec
Chord of the main rotor	1.52	feet
Chord of the tail rotor	0.61	feet
Span of the main rotor	29.3	feet
Span of the tail rotor	4.0	feet
Twist of the main rotor blade	-8.0	degrees
Twist of the tail rotor blade	0.0	degrees
Profile drag of the main rotor blade	0.0095	
Profile drag of the tail rotor blade	0.0105	
Disc loading of the main rotor system	6.96	
Width of the fuselage	7.08	feet
Length of the fuselage	31.3	feet
Frontal equivalent flat plate area	31.3	sq ft
Vertical equivalent flat plate area	36.0	sq ft
Maximum forward velocity	120	knots
Maximum range	505	nmi
Rate of climb	500	ft/min
Hover ceiling (IGE)	3,700	feet
Hover ceiling (OGE)	4,000	feet
Length of the tail	36.6	feet
Operating weight	13,600	pounds
Load weight	1,760	pounds
Fuel weight	5,640	pounds
Maximum gross weight	21,000	pounds

TABLE VI

S-76 Data

Parameter	Value	
Main rotor radius	22.0	feet
Tail rotor radius	4.0	feet
Number of main rotor blades	4	
Number of tail rotor blades	4	
Height of the main rotor system	10.0	feet
Speed of the main rotor	30.7	rads/sec
Speed of the tail rotor	168.0	rads/sec
Chord of the main rotor	1.29	feet
Chord of the tail rotor	0.54	feet
Span of the main rotor	17.0	feet
Span of the tail rotor	3.3	feet
Twist of the main rotor blade	-10.0	degrees
Twist of the tail rotor blade	-8.0	degrees
Profile drag of the main rotor blade	0.009	
Profile drag of the tail rotor blade	0.015	
Disc loading of the main rotor system	8.1	
Width of the fuselage	7.00	feet
Length of the fuselage	43.4	feet
Frontal equivalent flat plate area	11.6	sq ft
Vertical equivalent flat plate area	30.0	sq ft
Maximum forward velocity	155	knots
Maximum range	404	nmi
Rate of climb	425	ft/min
Hover ceiling (IGE)	6,200	feet
Hover ceiling (OGE)	2,800	feet
Length of the tail	26.5	feet
Operating weight	5,600	pounds
Load weight	2,520	pounds
Fuel weight	1,880	pounds
Maximum gross weight	10,000	pounds

TABLE VII

UH-60A Data

Parameter	Value	
Main rotor radius	26.8	feet
Tail rotor radius	4.0	feet
Number of main rotor blades	4	
Number of tail rotor blades	4	
Height of the main rotor system	11.2	feet
Speed of the main rotor	27.2	rads/sec
Speed of the tail rotor	125.0	rads/sec
Chord of the main rotor	1.75	feet
Chord of the tail rotor	0.81	feet
Span of the main rotor	29.3	feet
Span of the tail rotor	4.25	feet
Twist of the main rotor blade	-18.0	degrees
Twist of the tail rotor blade	-18.0	degrees
Profile drag of the main rotor blade	0.008	
Profile drag of the tail rotor blade	0.008	
Disc loading of the main rotor system	8.95	
Width of the fuselage	7.75	feet
Length of the fuselage	50.1	feet
Frontal equivalent flat plate area	25.7	sq ft
Vertical equivalent flat plate area	30.8	sq ft
Maximum forward velocity	156	knots
Maximum range	275	nmi
Rate of climb	200	ft/min
Hover ceiling (IGE)	7,800	feet
Hover ceiling (OGE)	3,900	feet
Length of the tail	31.5	feet
Operating weight	10,680	pounds
Load weight	7,270	pounds
Fuel weight	2,350	pounds
Maximum gross weight	20,250	pounds

TABLE VIII

CH-54B Data

Parameter	Value	
Main rotor radius	36.0	feet
Tail rotor radius	8.0	feet
Number of main rotor blades	6	
Number of tail rotor blades	4	
Height of the main rotor system	17.6	feet
Speed of the main rotor	19.4	rads/sec
Speed of the tail rotor	66.0	rads/sec
Chord of the main rotor	1.97	feet
Chord of the tail rotor	1.28	feet
Span of the main rotor	29.8	feet
Span of the tail rotor	6.45	feet
Twist of the main rotor blade	-8.0	degrees
Twist of the tail rotor blade	-8.0	degrees
Profile drag of the main rotor blade	0.0095	
Profile drag of the tail rotor blade	0.0105	
Disc loading of the main rotor system	10.3	
Width of the fuselage	7.08	feet
Length of the fuselage	70.2	feet
Frontal equivalent flat plate area	65.0	sq ft
Vertical equivalent flat plate area	99.4	sq ft
Maximum forward velocity	110	knots
Maximum range	200	nmi
Rate of climb	189	ft/min
Hover ceiling (IGE)	6,400	feet
Hover ceiling (OGE)	2,400	feet
Length of the tail	44.5	feet
Operating weight	19,230	pounds
Load weight	14,190	pounds
Fuel weight	8,580	pounds
Maximum gross weight	42,000	pounds

TABLE IX

CH-53D Data

Parameter	Value	
Main rotor radius	36.1	feet
Tail rotor radius	8.0	feet
Number of main rotor blades	6	
Number of tail rotor blades	4	
Height of the main rotor system	15.8	feet
Speed of the main rotor	19.4	rads/sec
Speed of the tail rotor	83.0	rads/sec
Chord of the main rotor	2.17	feet
Chord of the tail rotor	1.28	feet
Span of the main rotor	28.9	feet
Span of the tail rotor	6.45	feet
Twist of the main rotor blade	-6.0	degrees
Twist of the tail rotor blade	-8.0	degrees
Profile drag of the main rotor blade	0.0095	
Profile drag of the tail rotor blade	0.0095	
Disc loading of the main rotor system	10.3	
Width of the fuselage	8.83	feet
Length of the fuselage	67.2	feet
Frontal equivalent flat plate area	47.3	sq ft
Vertical equivalent flat plate area	90.0	sq ft
Maximum forward velocity	164	knots
Maximum range	242	nmi
Rate of climb	625	ft/min
Hover ceiling (IGE)	14,000	feet
Hover ceiling (OGE)	8,000	feet
Length of the tail	44.5	feet
Operating weight	23,630	pounds
Load weight	14,030	pounds
Fuel weight	4,340	pounds
Maximum gross weight	42,000	pounds

TABLE X

CH-53E Data

Parameter	Value	
Main rotor radius	38.5	feet
Tail rotor radius	10.0	feet
Number of main rotor blades	7	
Number of tail rotor blades	4	
Height of the main rotor system	16.0	feet
Speed of the main rotor	18.7	rads/sec
Speed of the tail rotor	73.0	rads/sec
Chord of the main rotor	2.44	feet
Chord of the tail rotor	1.28	feet
Span of the main rotor	28.6	feet
Span of the tail rotor	8.53	feet
Twist of the main rotor blade	-13.6	degrees
Twist of the tail rotor blade	-8.0	degrees
Profile drag of the main rotor blade	0.009	
Profile drag of the tail rotor blade	0.0095	
Disc loading of the main rotor system	15.0	
Width of the fuselage	8.83	feet
Length of the fuselage	99.0	feet
Frontal equivalent flat plate area	120.0	sq ft
Vertical equivalent flat plate area	63.6	sq ft
Maximum forward velocity	146	knots
Maximum range	400	nmi
Rate of climb	325	ft/min
Hover ceiling (IGE)	6,000	feet
Hover ceiling (OGE)	1,400	feet
Length of the tail	48.0	feet
Operating weight	24,790	pounds
Load weight	15,480	pounds
Fuel weight	25,480	pounds
Maximum gross weight	73,500	pounds

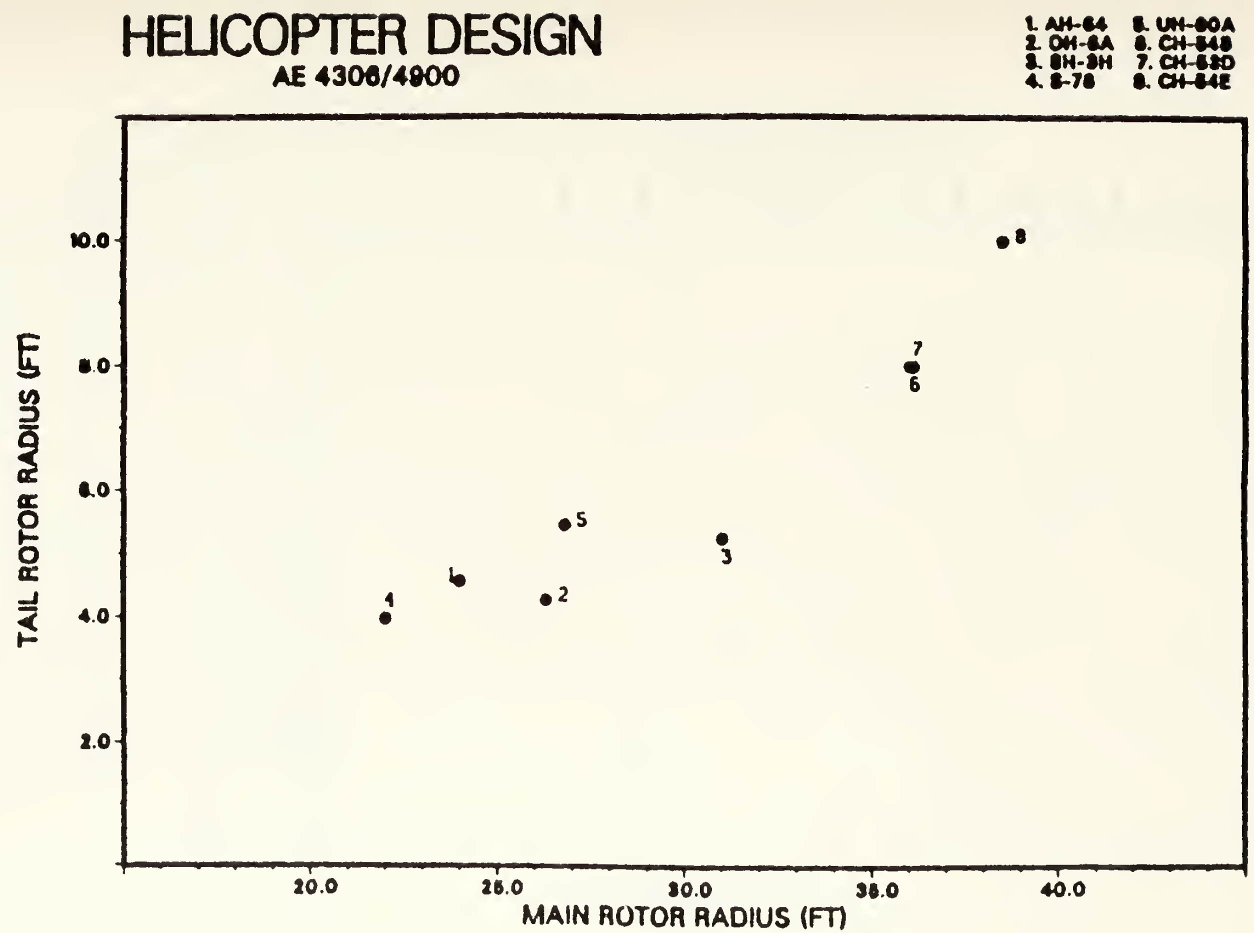

Figure 3.1. X-Y Plot (horizontal page format)

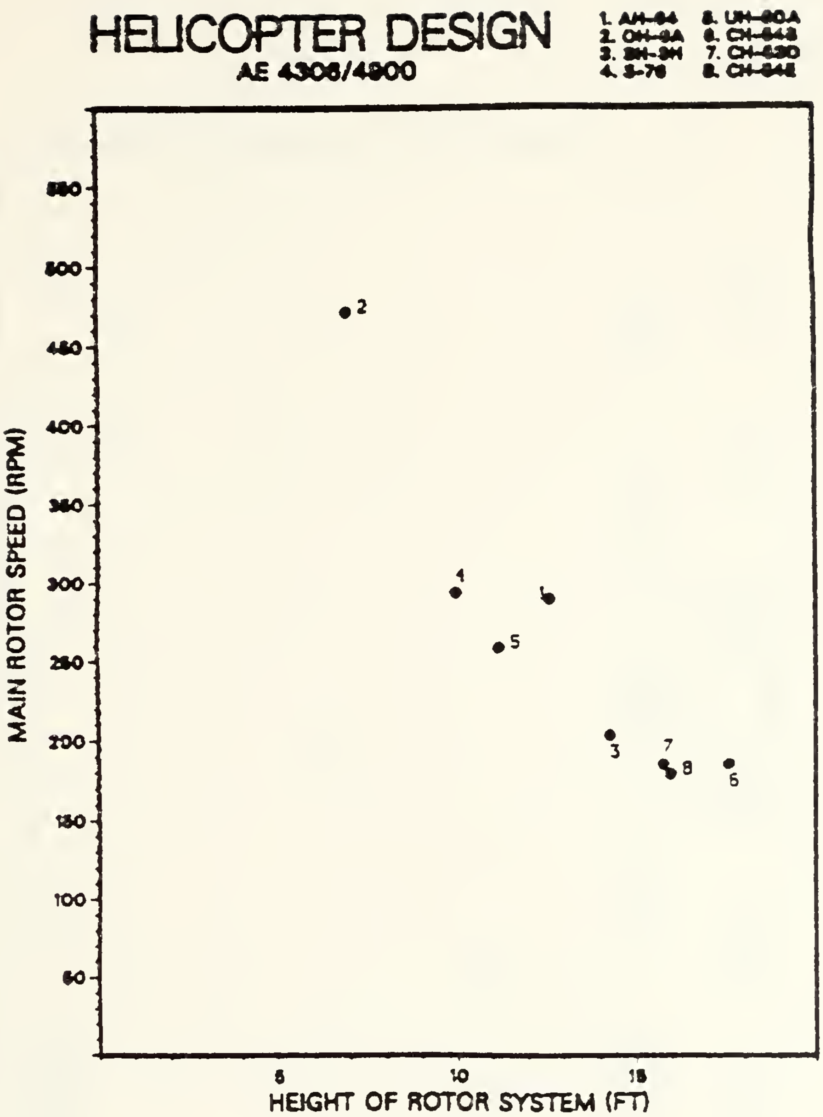

Figure 3.2. X-Y Plot (vertical page format)

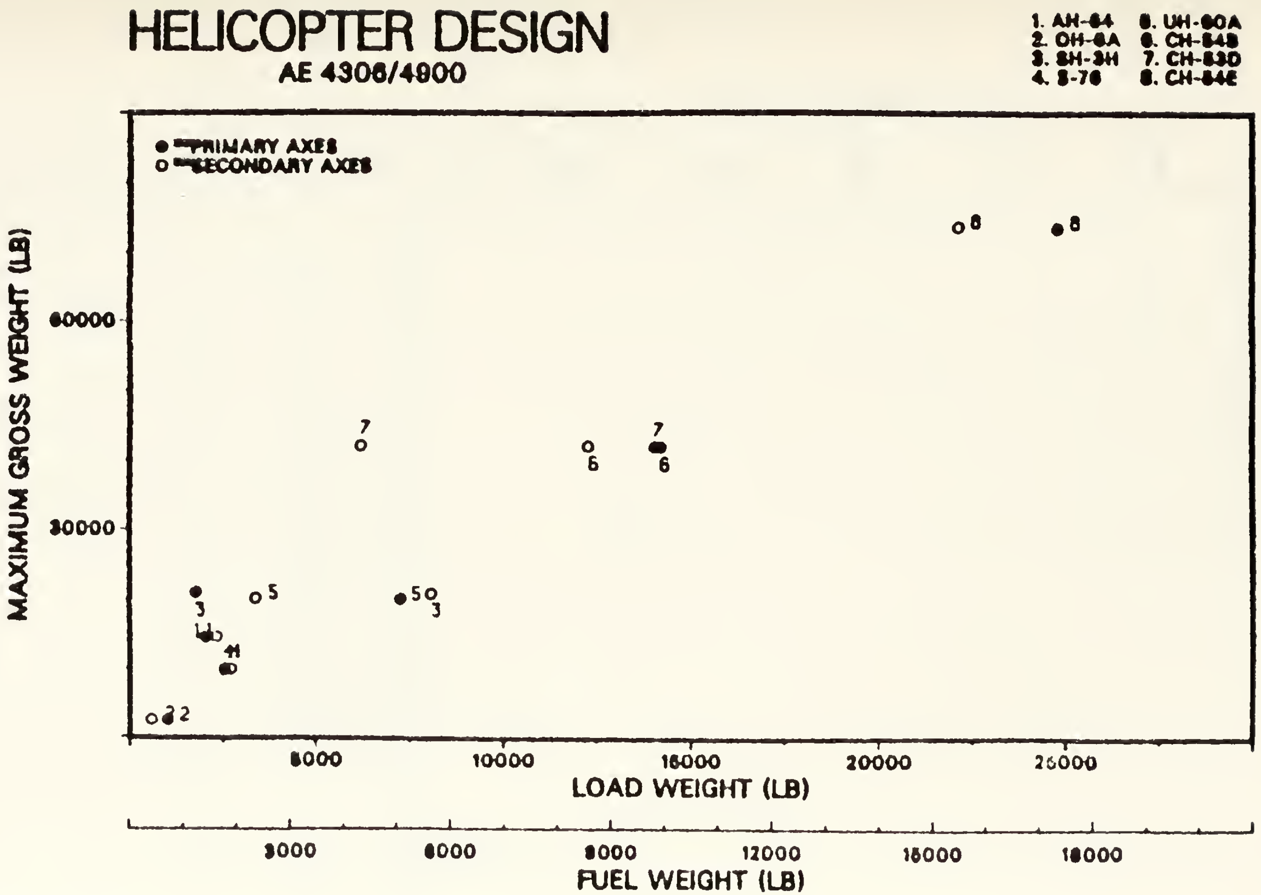

Figure 3.3. Multiple X Axes Plot (horizontal page format)

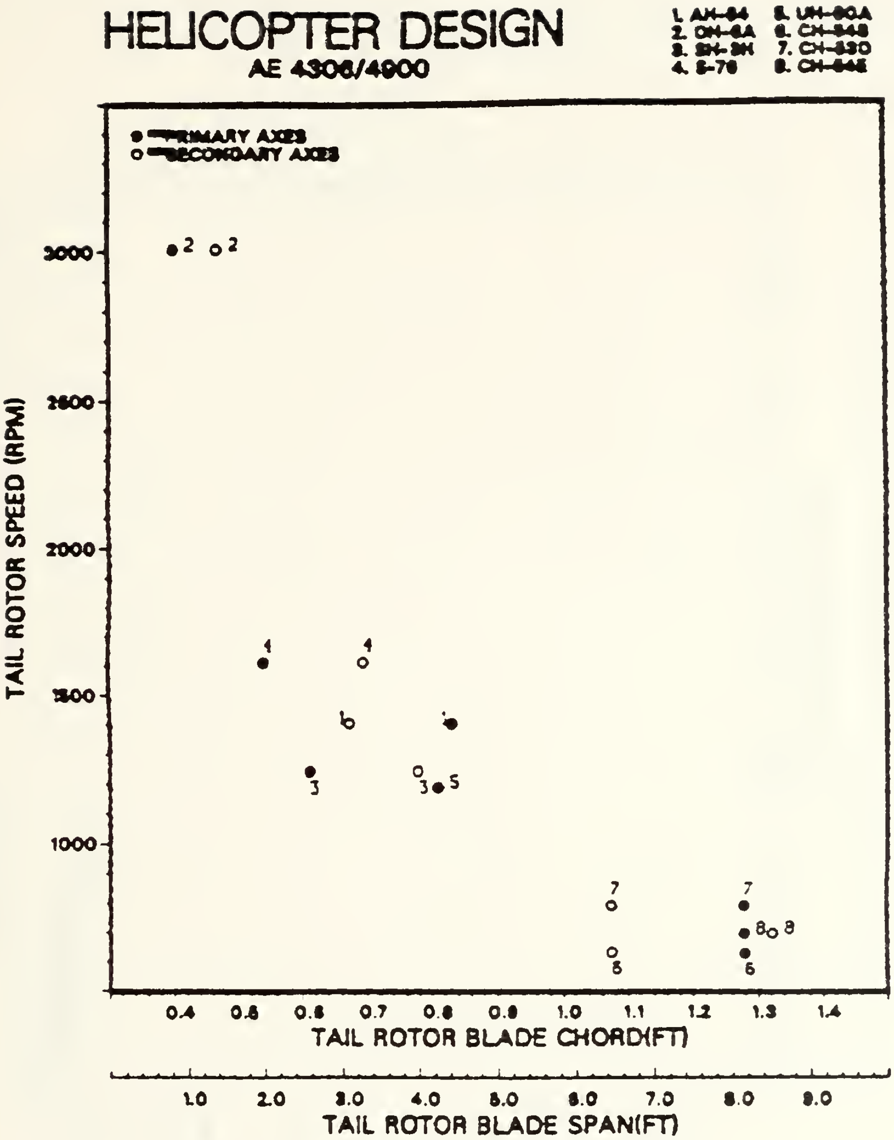

Figure 3.4. Multiple X Axes Plot (vertical page format)

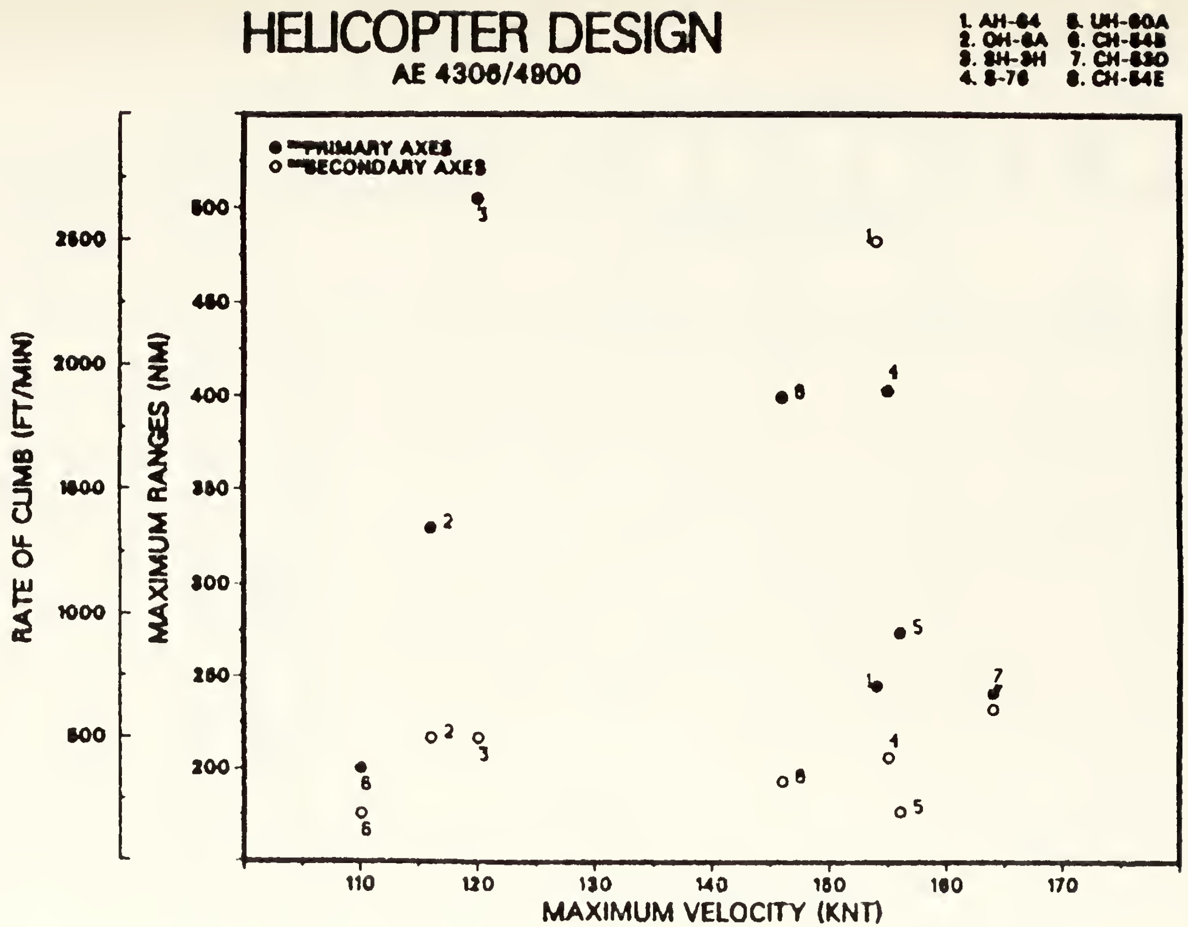

Figure 3.5. Multiple Y Axes Plot (horizontal page format)

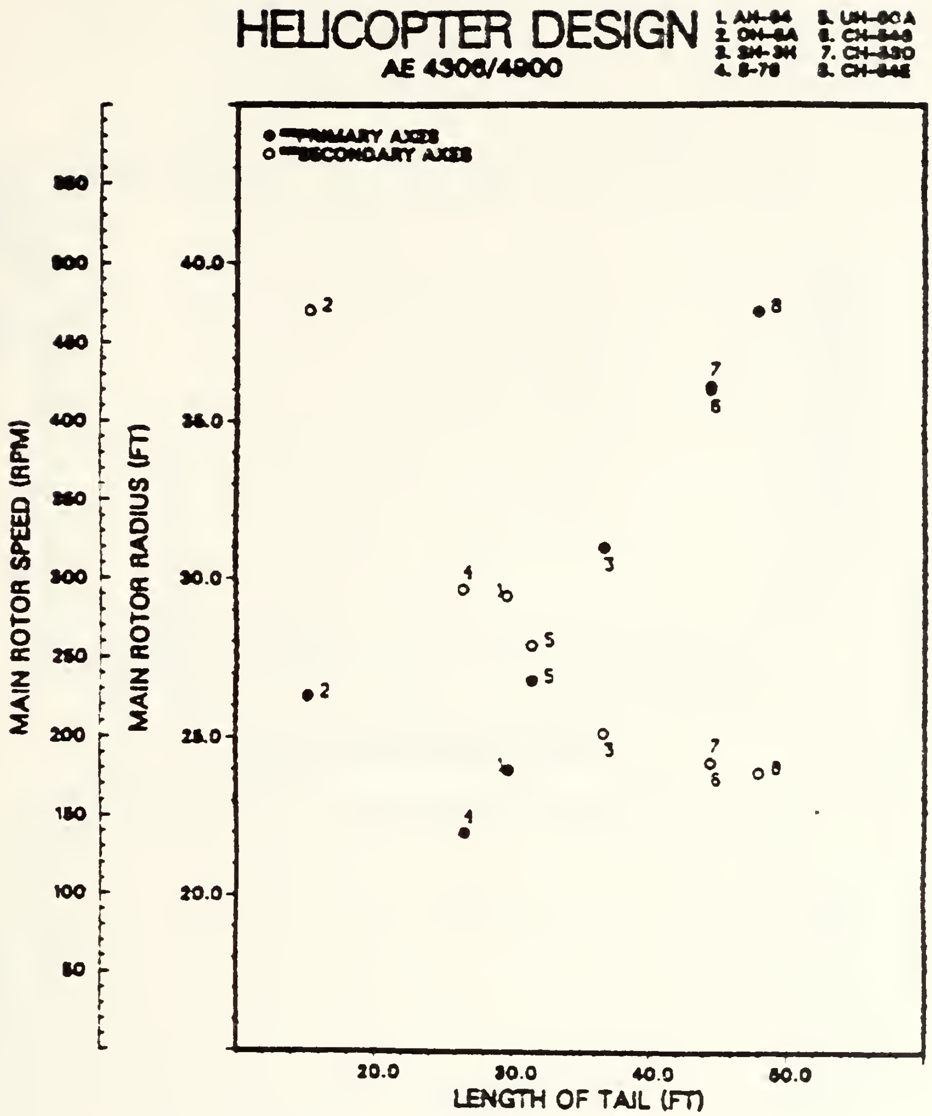

Figure 3.6. Multiple Y Axes Plot (vertical page format)

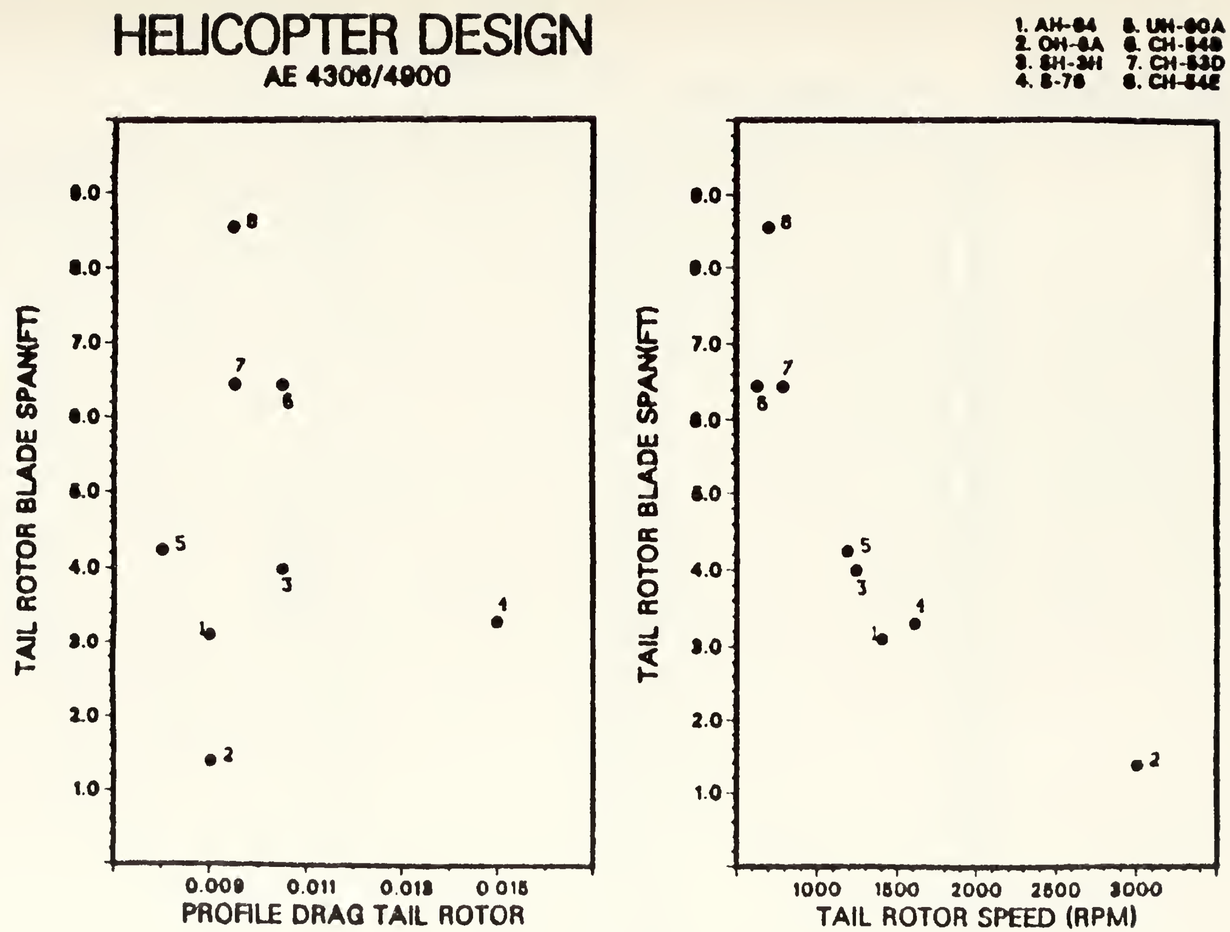

Figure 3.7. Two Plot Option

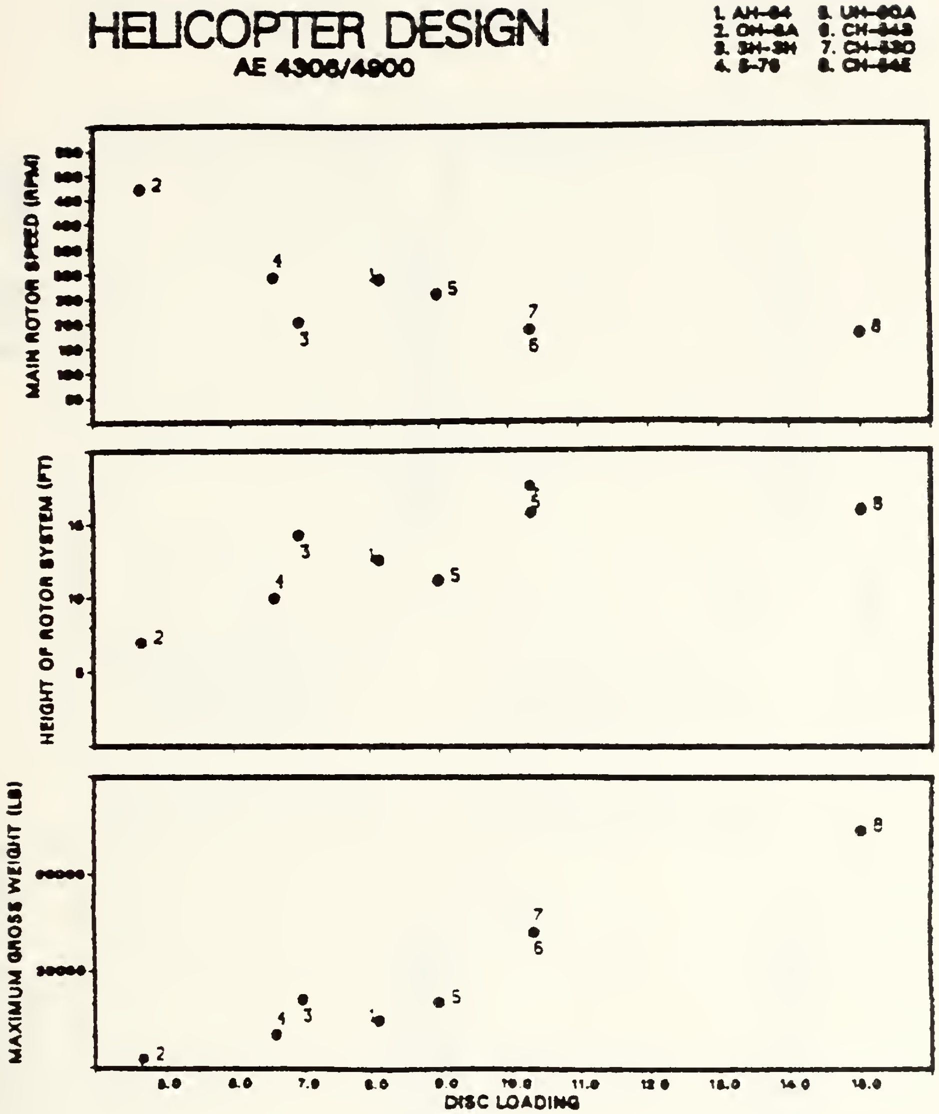

Figure 3.8. Three Plot Option

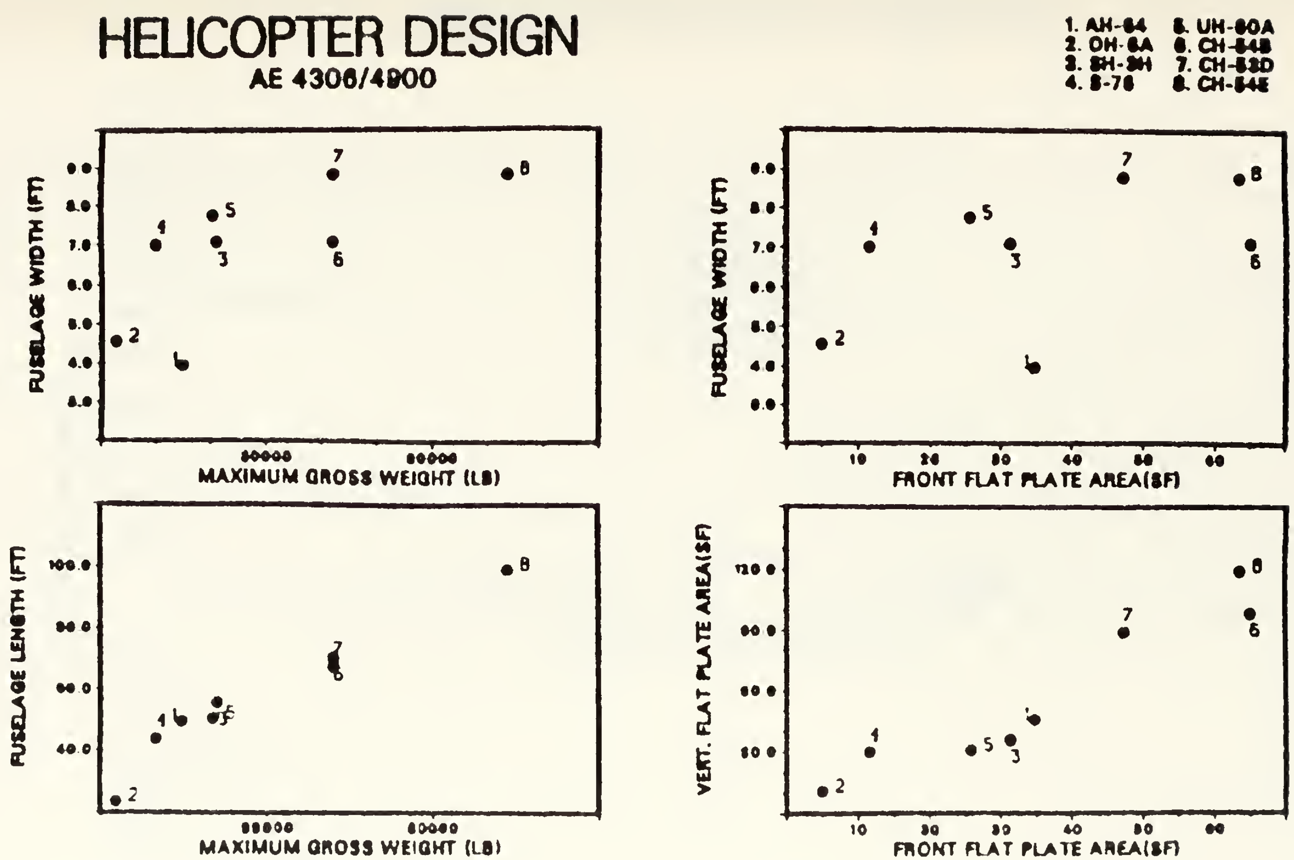

Figure 3.9. Four Plot Option

POWER VS. VELOCITY AT ALTITUDE

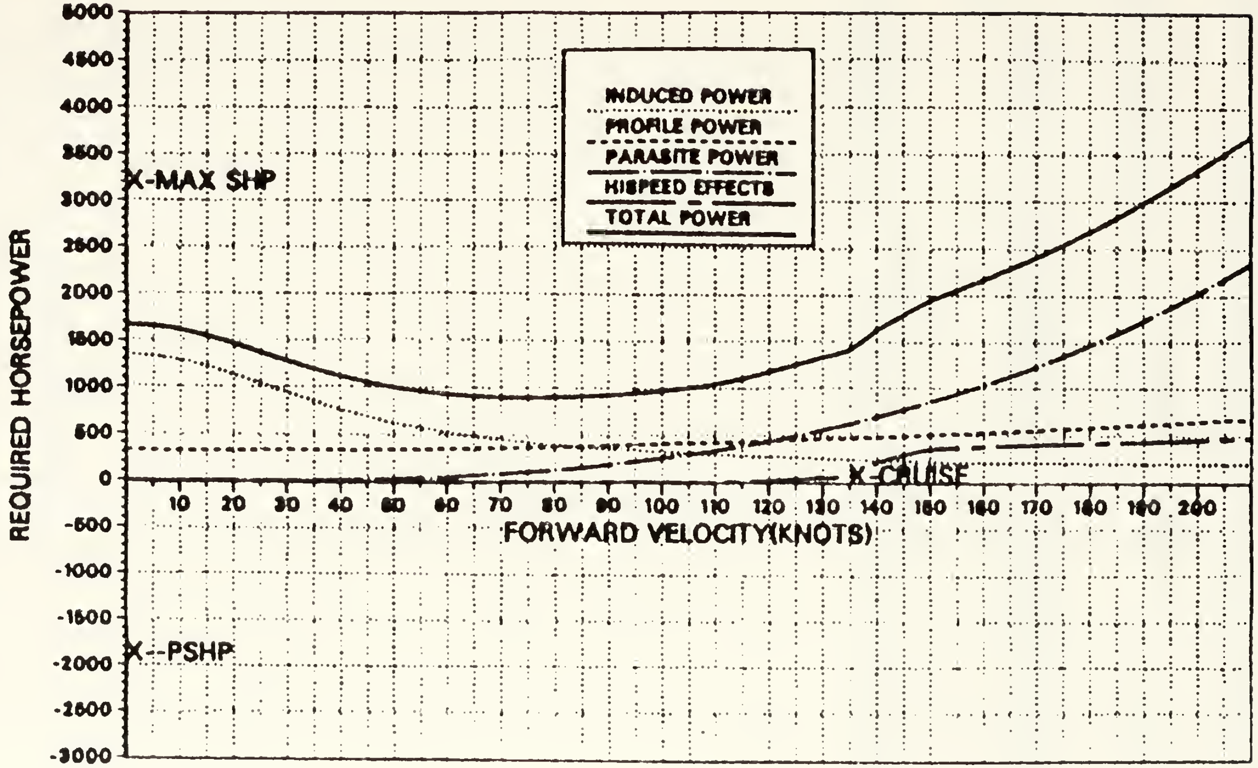

Figure 3.10. Sample Total Power Curve

BIBLIOGRAPHY

Casey, Timothy J., _Powerplant Selection for Conceptual Helicopter Design_, M.S. Thesis, Naval Postgraduate School, Monterey, CA, 1980.

Kee, Stephen G., _Guide for Conceptual Helicopter Design_, M.S. Thesis, Naval Postgraduate School, Monterey, CA, 1983

Rogers, Michael W., _Computer Programs for Preliminary Helicopter Design_, M.S. Thesis, Naval Postgraduate School, Monterey, CA, 1983.

Schwab, Rudolph T., _Computer Program Analysis of Helicopter Weight Estimate Relationships Utilizing Parametric Equations_, M.S. Thesis, Naval Postgraduate School, Monterey, CA, 1982.

Young, James E., _Helicopter Vertical Stabilizer Design Considerations_, M.S. Thesis, Naval Postgraduate School, Monterey, CA, 1980.

LIST OF REFERENCES

1. ISSCO Graphics, _DISSPLA Pocket Guide_, Integrated Software Systems Corporation, 1981.

2. Layton, D.M., _Helicopter Design Manual_, Naval Postgraduate School, 1983.

3. Layton, D.M., _Helicopter Performance_, Naval Postgraduate School, 1983.

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